THE MARINE REVIEW

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Must Avoid England's Mistakes

Washington Officials Have United Support of Marine Interests But British Experiences of Past 30 Months Should Be Analyzed Carefully

THE pressure of international developments has brought this country to a point where the probability rather than the possibility of war-like action on our part is freely discussed. National developments which owe their inspiration to the international situation have already brought several lines of private industry close to a wartime footing. As industries vitally needed in any scheme of national defense or offense, the shipping and ship building interests have already received that close national scrutiny which is preliminary to bringing their full resources into effective play—a scrutiny that well wishers of an American merchant marine have endeavored almost fruitlessly to encourage in peace times.

In the preliminary preparations now under way, it is inevitable that the 30-month experiences of the nations actually at war, should be drawn upon for suggestion and guidance. And it is a sober reflection of the deep and in many ways imperfectly understood influence of European events, that these initial preparatory measures begin at a point that three years ago would have been abhorrent to most Americans. Thirty months ago the most optimistic socialist did not foresee that governmental regulation of private industry would be a fact in nearly all Europe in 1917.

A Chance To Avoid Mistakes

In a republican form of government like ours, great crises usually precipitate vigorous but in too many cases mistaken activity. Starting from the bottom, as we necessarily do, we possess almost every opportunity for making mistakes and the wide appreciation of this fact explains the comparative leniency with which we regard mistaken but energetic zeal. The close parallel between conditions which would face this country if belligerency replaces neutrality and those confronting England in August, 1914, gives our national administration precedents to follow that the Asquith government lacked.

In a consideration of the measures already adopted or proposed for a more active governmental participation in shipping and ship building affairs, we find the influence of England's action but not as generally an appreciation of her experiences. At the request of the navy department, for instance, private ship builders who are busy on governmental as well as private contracts, are now furnishing Secretary Daniels with complete data of their facilities. This information, Daniels says, is desired for two reasons: to ascertain the present capacity and possible future capacity, and to determine the use to which the government could put the yards in case they were taken over. Similar information is to be requested later of yards which are not at work on governmental contracts.

What the War Taught England

The necessity for such information being quickly available at Washington is readily apparent. The judicious employment of the opportunities which the information may disclose, is essential. It has been intimated that the yards might be required to concentrate their full resources on governmental work to the exclusion of private business now on the books. But a portion of England's troubles since Germany's declaration of Feb. 1, is based on a similar decision by the British admiralty in the early months of the war. Merchant vessels were put aside in order to expedite naval construction, and it required stern national necessity to drive home the fact that the former class of ships had their war uses, almost equally as important as a battleship or a destroyer. Now the completion of merchant vessels launched or started several years ago is being rushed. Careful consideration must be given at Washington to the needs of our merchant marine as well as our battle fleet. And when considering governmental regulation of shipping, England's difficulties should be thoughtfully analyzed.

The present opportunities for statesmanship are innumerable, the need for wise decisions is imperative. The government has the country's whole-hearted support and the burdens involved in giving effectiveness to this support will be accepted hopefully and cheerfully.

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Four-Year Test of Motorship Fleet

Results Secured by Big Danish Shipping and Trading Company in Operating a Large Number of Motorships—Details of Operating Costs and Experiences

THE East Asiatic Co. is a large shipping, trading and manufacturing concern whose business extends from its headquarters at Copenhagen, Denmark, to practically all parts of the world. The shipping activities of the company have steadily extended year by year until now its fleet includes 16 ships of 114,611 tons carrying capacity, with 23 additional vessels under order. In addition to this main fleet, several subsidiary concerns operate fleets in various parts of the world.

The recent history of this company is extremely interesting owing to the quickness with which the directors determined to adopt motor vessels as the standard for their fleet. Some years ago, when the motor vessel was still looked upon with skepticism by some marine interests, the East Asiatic Co. had already decided to test the advantages and disadvantages of these vessels in actual service. The first motor ships were delivered in 1912 and on Dec. 31 of that year the company's fleet included 13 steamships and two motor ships. Three years later, the company's fleet included 16 motor ships and no steamers.

The Marine Review has been able to secure a complete and interesting history of the company's experience with motor ships. The following installment describes the operations of the first two motor ships ordered by the East Asiatic Co., giving not only the physical details of their construction, but the actual costs of operating the boats. In the immediately following issues, further excerpts from the company's experience will be presented. The complete series will form an invaluable contribution to the literature on motor ships, presenting as it does the concise reasons which led a large and important shipping company to change the character of its fleet.

Immediately following the present installment is a description of the motor ship COLUMBIA, one of the East Asiatic Co.'s newest vessels. She embraces in her design several innovations, the value of which has been demonstrated by the operations of the older vessels of the company's motor ship fleet.

THE East Asiatic Co. placed its first order for a motor ship in 1910. The following account is taken from the report of the officers of the company for the years 1911 and 1912, when the motor ships were first placed in service:

The motor ship SELANDIA's successful trial trips have established an active interest in the question of diesel engines for marine propulsion. A few facts relating to the new vessel may, therefore, prove of interest.

Builds First Big Motor Ship

In the report for 1910 it was stated that three vessels of 6,800 tons deadweight each had been ordered about the end of that year. By means of a more advantageous freeboard the carrying capacity of each has since been increased to 7,400 tons. SELANDIA is the first of these vessels. She is a twin-screw vessel provided with accommodation for 20 first-class passengers. She is propelled by two main diesel engines of 1,250 horsepower each and is, besides, fitted with two auxiliary motors of 250 horsepower each, driving the electrical loading and discharging machinery, pumps and steering gear, electric lights, refrigerators, ventilators, etc.

SELANDIA, after several satisfactory trial trips, was taken over from Messrs. Burmeister & Wain on Feb. 17, 1912, the motor ship JUTLANDIA, building at Messrs. Barclay, Curle & Co.'s yard at Glasgow—the engines being designed by Messrs. Burmeister & Wain—is expected to be completed about the end of April, and the motor ship FIONIA, building at Messrs. Burmeister & Wain's, at about the end of May.

Why Motor Ships Were Built

The company was induced to build motor vessels in consequence of the following advantages:

1. The saving effected by using oil instead of coal may, under the oil contract made by the company over a series of years, be estimated at more than 50 per cent.
2. The increased loading capacity obtained through less weight of machinery, as well as increased cargo space gained by the absence of coal bunkers, and larger carrying capacity owing to differences in the respective weight of quantities of oil and coal.
3. Calling at ports for filling bunkers and loss of time connected therewith are avoided. A steamship on the far eastern trade will require to coal at eight or 10 different ports, whereas a motor vessel need only take in oil at one or two ports. Further, the drawbacks attending coaling and stoking are got rid of, savings are in this way effected and expenses for maintenance reduced. Moreover, there is no heating of the vessel from the boilers which, particularly in the tropics, is of great importance to the cargo. Also the danger of spontaneous combustion is diminished.
4. The cost price of a motor ship like SELANDIA is about 10 per cent higher than that of a corresponding steamship, but on the other hand the loading capacity is larger by about 10 per cent, so that the gain per ton carrying capacity will amount to about the same.

From Messrs. Burmeister & Wain the company has further ordered two twin-screw motor vessels, each of about 10,000 tons carrying capacity. They are intended for the China-Japan line, and are expected to be ready in the spring of 1913. All the five ships are designed for an average speed of 11½ knots fully loaded.

Report for 1912

Shipping Department.—Of the motor vessels referred to in our last report, FIONIA was transferred to the Hamburg-American Line immediately after completion, whereas SELANDIA and JUTLANDIA were placed for service on the Siam Line in February and June respectively. The experience gained by the performance of these vessels came up to expectations. The motors worked satisfactorily in the different weathers and climates, and the two essential points, viz.: savings derived from the consumption of oil as compared with that of coal, and the increased earnings from freight owing to the comparatively larger carrying capacity of the motor ships, fulfilled expectations.

In order to utilize the advantages offered by this type of vessel on special routes where the supply of oil can be obtained on moderate terms, the company has now in course of construction seven additional motor vessels, aggregating about 60,000 tons

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dead weight. Also installations of diesel engines in the steamers BANDON, CHUMPON and PANGAN have been contracted for, and three new steamships, each of about 7,000 tons dead weight, have been ordered for the South Africa Line.

Cost of New Ships

The vessels of the company are specially built for liner service, and are therefore more expensive than ordinary cargo vessels. The average cost per dead weight ton of the vessels built to the order of the company up to the close of 1911 amounted to £10 13s 10d, whereas for the vessels under construction it will amount to £10 18s 0d, or only about 4s more, although three-fourths of the new tonnage are motor vessels. This is due to the fact that larger ships of the company's type are comparatively cheaper than smaller vessels.

In order to enable the company to provide for the transport of cargo on its routes 28 steamers, aggregating about 170,000 tons deadweight, had to be chartered.

The company has up to the present time followed the practice of defraying all expenses for maintenance, repairs and classifications of its vessels out of its trading profit, and to write off for depreciation 5 per cent of the original cost value, whereby the total cost of a ship is written off in the course of 20 years. In view of the rapid development of naval architecture and the requirements of specially constructed vessels for service on the regular routes, it has now been decided to write off the ships in the course of 15 years. Corresponding amounts have been written off for the past year.

The report for 1911 contained an appendix stating the reasons which prompted the company to build motor vessels for ocean service. In view of the extension of the company's tonnage, more especially by motor vessels, as dealt with in the present report, it will be of interest to supplement the statement of 1911 referred to above.

If the motor ships SELANDIA and JUTLANDIA had been fitted with steam engines with corresponding power to that of their diesel oil engines, their coal consumption would have averaged about 40 tons in 24 hours, whereas the oil consumption on their maiden voyages averaged 9 tons per 24 hours, and has since been gradually reduced to 8 tons. The design of the diesel engines in the motor vessels now building to the order of the company has been improved and a further reduction in the oil consumption is expected.

Owing to the high temperature prevailing in the stokeholds of steamers in the tropics, particularly in the Red sea, difficulties are usually experienced—and often with a greater consumption of coal—in keeping up normal steam on the boilers, followed by decrease in speed. In motor ships these circumstances are reversed. The thick oil used for the diesel engine becomes thinner under the influence of the tropical heat. This improves the automatic injection whereby the consumption of oil is reduced while the speed increases.

One advantage in the diesel marine engine as compared with the marine steam engine is that one or more of the cylinders, all of which work independently of each other, can in case of need be instantaneously disconnected without the stoppage of the engines for that purpose. There have been no difficulties in the tropics in keeping the engines cooled by means of sea or river water. A steamship, especially after a stay of several days in port, requires from 12 to 24 hours for raising steam and making the engines ready to start, whereas the marine oil engine is ready to start at a few minutes' notice.

The marine boiler, including the piping, etc., is a source of considerable expenditure for maintenance. The boilers, when a steamship grows older, are its weak point, and usually require extensive repairs and renewals. The same applies to those parts of the vessel surrounding the boiler space, such as the bottom and sides of the ship, which are affected comparatively soon by corrosion caused by the heat radiating from the boilers as well as by the moisture contained in the coals, thereby affecting the vessel's sides in places where coal is bunkered. This drawback is dispensed with in motor vessels, where no boilers are required. The bottom tanks, which in a steamship are generally used for ballast, usually sea water, causing corrosion, are in motor vessels employed for storing fuel oil which prevents corrosion, a fact of special importance in places difficult of access for general maintenance.

Durability of Parts

The bedplates and fixed parts of the diesel marine engine are heavier than the corresponding parts in the marine steam engine and just as durable. The diesel marine engine has less internal working parts and is therefore less complicated than a marine steam engine. The external working parts of the motor are just as strong as the corresponding parts of an ordinary marine steam engine. SELANDIA, which was completed under difficult circumstances in the middle of a severe winter, has suffered from fewer initial difficulties and troubles than several of the company's steamships during their maiden voyages. The minor shortcomings, for instance, in regard to the exhaust valves, have been remedied, and the experience gained has been taken advantage of in the design of the later motors.

Judging by the data on hand it would appear that the fixed as well as the working parts of the diesel marine engine, have as long a life as those of the marine steam engine, and also that repairs and renewals to its working parts will not exceed those to the corresponding parts of the steam engine.

The smaller weight of the diesel en-

East Asiatic Company's Fleet on Dec. 31, 1912

Name	Year built	Tons, gross, registered	Tons, dead-weight	Indicated horse-power
Steamship Arabian	1911	4,714	8,720	2,700
Steamship Kina	1911	4,714	8,720	2,700
Steamship Indien	1902	5,199	7,400	2,000
Steamship Cathay	1898	4,075	6,600	1,600
Steamship Tranquebar	1906	3,453	6,800	1,650
Motorship Selandia	1912	4,964	7,450	2,500
Motorship Jutlandia	1912	4,874	7,600	2,500
Steamship Pangan	1909	3,487	4,900	1,600
Steamship Chumpon	1909	3,481	4,900	1,600
Steamship Bandon	1909	3,485	4,900	1,600
Steamship Samui	1907	2,861	4,500	1,300
Steamship Bintang	1907	2,860	4,500	1,300
Steamship St. Croix	1907	2,540	3,500	1,350
Steamship St. Thomas	1907	2,487	3,500	1,350
Steamship St. Jan	1907	2,478	3,500	1,350
		54,672	87,490	

NEW VESSELS CONTRACTED FOR TO BE DELIVERED IN THE COURSE OF 1913 AND 1914.

Name	Tons, gross, registered, about	Tons, dead-weight, about	Indicated horse-power
Motorship Siam	5,500	10,000	3,300
Motorship Malakka	5,500	10,000	3,300
Motorship Annam	5,500	10,000	3,300
Motorship Tongking	5,500	10,000	3,300
Motorship Fionia	5,000	7,000	4,100
Motorship Falstria	4,500	7,000	2,500
Motorship Lalandia	4,500	7,000	2,500
Steamship Natal	4,000	7,000	1,600
Steamship Transvaal	4,000	7,000	1,600
Steamship Rhodesia	4,000	7,000	1,600
	48,000	82,000	

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gine and the fuel oil carried in motor vessels, as compared with the weight of the engine and coal in steamships, has resulted in larger freight receipts owing to increased carrying capacity, and to this must be added the considerable advantage that has accrued from motor vessels being able to cross the river bar at Bangkok, inwards as well as outwards, with a larger quantity of cargo which would otherwise have had to be lightered.

Not only has the loss of time generally involved in coaling been avoided, but also the maintenance of the ships has been reduced and savings effected in respect of painting and in other ways. The results attained by SELANDIA have increased the interest in the marine diesel engine, and, more particularly in England and Germany, ships are under construction for propulsion by diesel oil engines of various designs, notably engines of the 2-cycle description. The engines in the motor vessels of the SELANDIA type as well as in the motor vessels building to the order of the company are of the 4-cycle description, but while the engines of SELANDIA have 16 cylinders, developing 2,500 indicated horsepower, the engines of the ships now building have only 12 cylinders, occupying less space but developing greater power. Thus the 12 cylinders of FIONIA, now in course of construction, will be capable of developing 4,100 indicated horsepower. The engines of the 2-cycle type occupy less space than those of the 4-cycle description, but the consumption of oil, as far as can be ascertained at present, is greater.

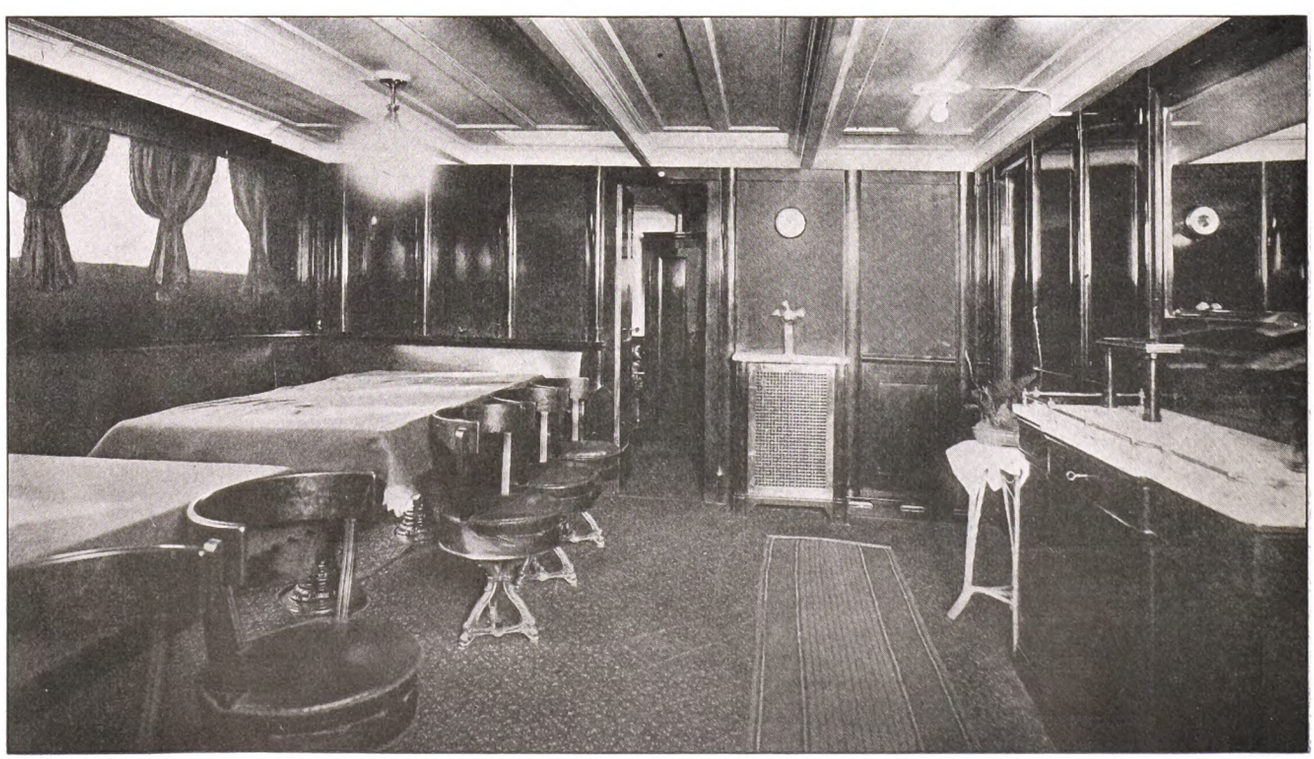
The development in the building of motor vessels for the merchant marine depends chiefly on the supply of oil. In this respect motor ships are, at present, limited to routes where oil can be obtained on terms that will enable it to compete with coal. The use of the diesel motors for marine propulsion is for the time being confined to vessels of a certain size and speed.

Columbia---Motorship of Latest Type

ONE vessel of the East Asiatic Co.'s new fleet of some 20 motorships which has visited this country is COLUMBIA. Twice during 1916 she called at New York to take on a cargo of case oil for China. This splendid vessel, sistership to CHILE and PERU, was launched Oct. 13, 1915, from the yard of the Burmeister & Wain Engine & Ship Building Co., Copenhagen, Denmark, builder of SELANDIA, the first successful diesel engine propelled vessel. SELANDIA was launched in 1909. Although embracing all the principles of the Burmeister & Wain company's established standard of design, COLUMBIA'S motor installation embodies several minor revisions. One of these is the maintenance of the blowing air at a pressure of 60 atmospheres instead of 75 as in former vessels.

COLUMBIA is a twin-screw vessel and her driving units are two 1,600-horsepower, 6-cylinder, 4-cycle engines located amidship. The engines have a piston stroke of 960 millimeters (37.7952 inches), piston diameter of 630 millimeters (25.0031 inches), and a speed of 125 revolutions per minute, imparting to the vessel a speed of 11.2 nautical miles per hour when loaded and 12.5 miles when light. The fuel for the engines, which is low-grade oil obtained by the East Asiatic Co. from Borneo, is stored in eight tanks at the bottom of the hold; these have a total capacity for 1,248 tons. The oil is consumed at the rate of 128 grammes (4.3287 fluid ounces) per horsepower. hour, making the total expenditure of oil, while the vessel is en route, about 10.3 tons per day of 24 hours.

In addition to the main driving units, the engine room is equipped with three 100-horsepower diesel engines, direct connected to dynamos, which furnish current for operating the motors and electric lights throughout the vessel. Auxiliary equipment in the engine room includes tanks for maintaining the starting air at 25 atmospheres pressure; a motor-driven air compressor; two motor-driven bilge and sanitary pumps; a compressor, driven by one of the main units, for feeding the starting air bottles; two motor-driven pumps for cooling the cylinders and pistons of the



FIRST-CLASS PASSENGER SALOON

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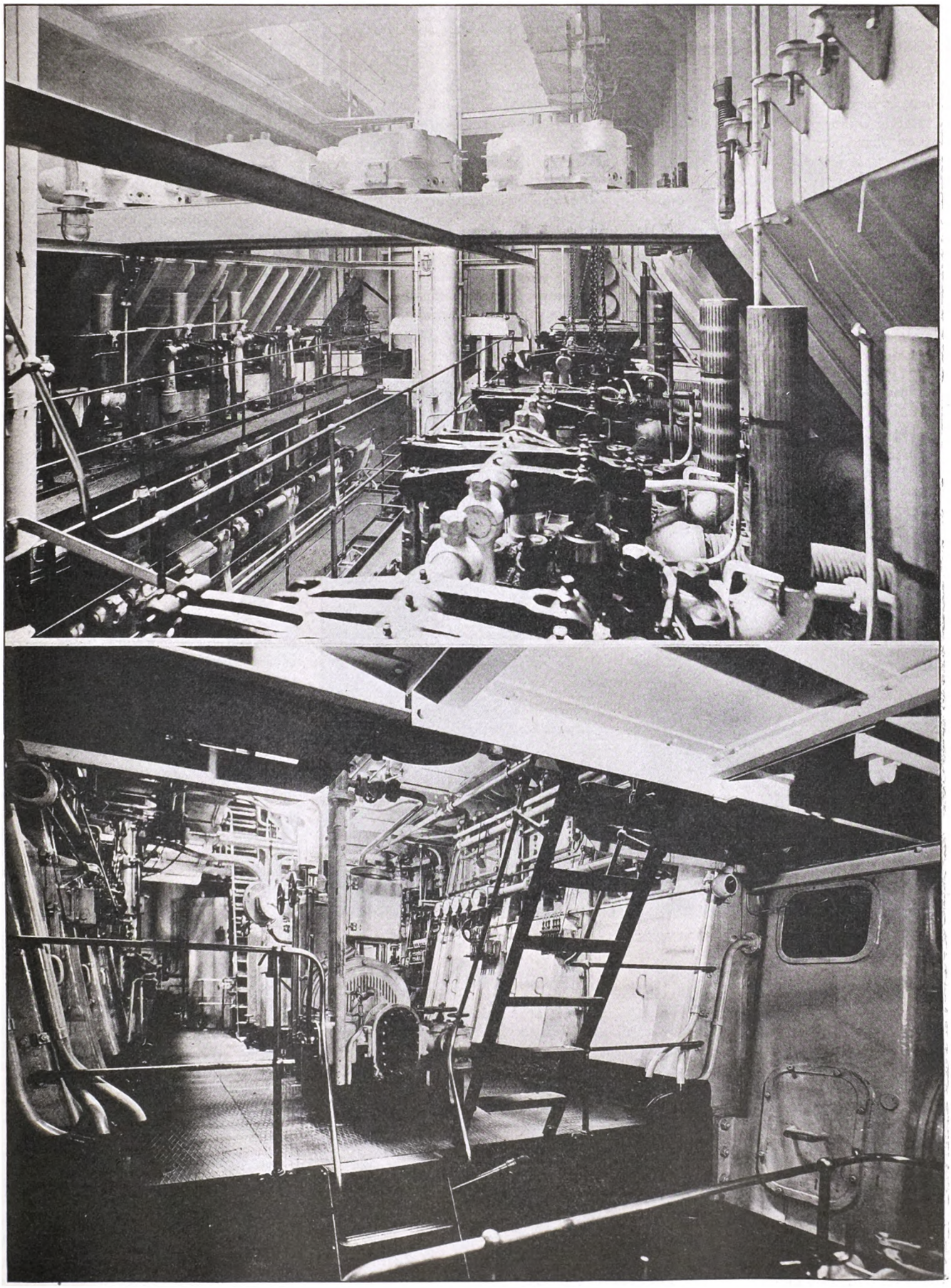

VIEW ACROSS TOPS OF ENGINES OF MOTORSHIP COLUMBIA

MANEUVERING PLACE IN ENGINE HOLD OF MOTORSHIP COLUMBIA

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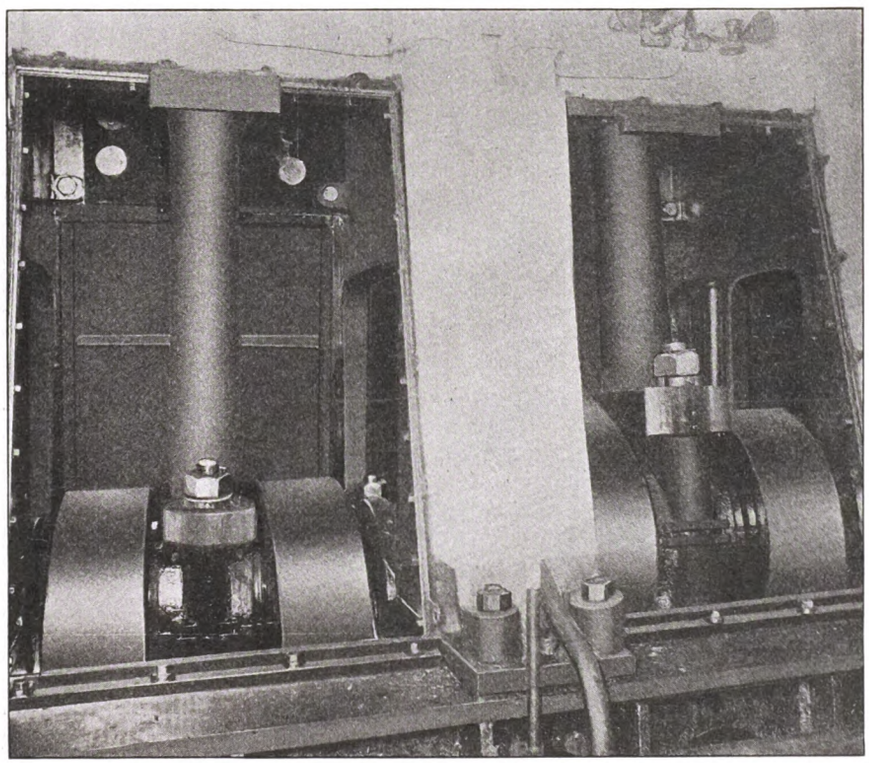
diesel engines and the air compressors; a motor-driven gear mechanism for turning the crank shafts in order to facilitate the cleaning and overhauling of the engines when in port; a motor-driven ballast pump; motor-driven pumps, which are used twice daily, for elevating oil to the settling tanks in order that it may be filtered before using; a miniature machine shop, etc. Steam is employed on this vessel only for heating the living and working quarters of the officers and crew.

In addition to possessing accommodations for officers and crew which are unusually well appointed for a merchant vessel, COLUMBIA has staterooms for 10 first-class passengers. She is a general cargo boat with six hatches and six cargo holds and is provided with 14 boatswain, one carpenter, eight able seamen and two ordinary seamen. Her engine room staff comprises three engineers, one electrician, five assistant engineers and four oilers. The unusually large number of assistants is due to the necessity for training men to man the new motor ships which are to be launched into the East Asiatic Co.'s service in the future.

An interesting feature of the vessel is the steering mechanism. The steering gear is actuated by a motor-driven hydraulic pump in which glycerine is employed as the fluid, due to its anti-freezing properties. The motion of the pump valve, by which the fluid pressure is applied either to the port or the starboard cylinders, as desired, is regulated by the tiller motor on the bridge.



CRANKSHAFT CABINETS WITH DOORS REMOVED

winches and one windlass, all operated electrically. Her length overall is 440 feet, and at the water line 425.5 feet, her molded breadth 55 feet, molded depth 30.5 feet, draught 26 feet 8 inches in salt water, gross registered tonnage 5,570 tons, net cargo tonnage 3,490 tons and deadweight capacity 9,600 tons. Her grain loading space is 557,350 cubic feet, and her bale space 521,020 cubic feet.

COLUMBIA is four-masted, schooner-rigged, nicely raked for appearance, and the masts are provided with booms for handling the cargo; a few sails are carried for use in case of distress. She is built on the awning deck principle, having an awning deck, main deck and 'tween deck. Her deck crew comprises the captain, three mates, one

Record Ship Prices

Lloyds, at London, England, have issued particulars of the vessels sold during the last quarter of 1916, and some of the prices mentioned are more extraordinary than any yet reported. For instance, KAIFUKU MARU was built in 1892 and was sold in 1907 for $43,798. She has just been resold for $729,975. The steamer HERCULES was built in 1903 at a cost of $200,000, was sold in 1904 for $161,250, and has now been resold for $1,300,000. GOZAN MARU, built in 1898, was sold in 1913 for $122,500, and has now been resold for $875,000. A very old boat, MIAOULIS, of 4,450 tons, built in 1893, was sold in 1905 for $75,000, in 1907 for $77,500, and is reported now to have realized $592,500.

Book Review

Practical Ship Building, by A. Campbell Holms; in two volumes, cloth, published by Longmans, Green & Co. Volume I has 640, 6 x 10-inch pages; Volume II has 115, 12½ x 15-inch diagrams and illustrations. The books will be furnished by *The Marine Review* for $17.50 net.

Practical Ship Building is a complete treatise devoted to the structural design and building of modern steel vessels. Its scope embraces the various steps in ship construction, beginning with the making of the raw materials which are used in construction and ending with the equipped vessel. Discussions are given on subsequent upkeep and repairs. The subjects that embrace theoretical questions of naval architecture are presented in such a way that those who wish to obtain accurate knowledge of structural design may grasp the fundamental laws without being unduly hampered by anything of an abstruse nature.

The basic principles of structural designs are presented in the first few chapters of the book. These include discussions of the various stresses to which the hull is exposed, their straining tendency, and the various design schemes by which the necessary resisting strength is obtained. The hull, both alone, and in its important parts is considered from three different viewpoints: Its purpose as an integral part of the structure and the particular stresses and strains to which it is liable; the various formations adopted in the hull design and their relation to its strength; and a description of the actual work of making it in a ship yard.

The author emphasizes the importance of the work of the drawing office where the qualities of the ship are determined. Several chapters pertain to corrosion, launching, and kindred subjects. Commendable attention is given to the many materials entering into the complete vessel. The diagrams and illustrations of Volume II conform with Lloyds rules and are of particular interest and value to the construction engineer.

This is the third edition of *Practical Ship Building*. Revised, it includes consideration of the new features of the industry which have been inaugurated since the last edition. The book will be found useful for reference and is excellently arranged for systematic study.

Another wooden-ship building company was launched in Seattle when the National Shipbuilding Co. was incorporated with $40,000 capital by Capt. O. D. Treiber and F. C. Norbeck. The new company will take over the plant of Johnson Bros. & Blanchard, on the Duwamish waterway. Capt. Treiber is a naval architect and ship builder of years of experience on the Pacific coast.

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America's Harbor Bill

By Herman Bleyer
Secretary, Milwaukee Harbor Commission.

The figures embraced in the statistics presented herewith, and accompanying information, were gleaned from the annual report of the chief of engineers of the United States army; also from "Ports of the United States," a report of the terminal facilities, commerce, port charges and administration at 68 selected ports of the United States, by Grosvenor M. Jones, commercial agent of the department of commerce; also from the report of the Chicago harbor commission, and from various other sources. In many cases greater harbor outlays are in contemplation, but the figures given show the amounts in hand or actually expended up to and including the year 1914. Blanks indicate no expenditure. The compiler was unable to secure the actual freight tonnage handed in the harbors of the Dominion of Canada, or the expenditures, which is likewise true of the harbors of the old world. The tables show the tonnage of each port, the value of its commerce and the expenditures of the national and local governments for harbor improvements up to Jan. 1, 1915. Since that date accurate figures are not available.

Latest Marine Patents

Copies of any one of the following patents can be obtained by sending 15 cents in stamps to Siggers & Siggers, patent lawyers, National Union building, Washington, D. C., by mentioning *The Marine Review.*

1,215,383—Two-cycle internal combustion engine. Bertram C. Kenyon, Mishawaka, Ind., assignor of one-half to Dodge Mfg. Co., Mishawaka.

1,215,387—Torpedo launching apparatus for submarine boats. Simon Lake, Milford, Conn., assignor to the Lake Torpedo Boat Co. of Maine, Bridgeport, Conn.

1,215,483—Two-cycle internal combustion engine. Sylvester Charles, San Jose, Cal.

1,215,808 — Compass. Robert Huntington, South Medford, Mass.

1,215,863—Internal combustion engine. Andrew L. Riker, Bridgeport, Conn., assignor to the Locomobile Co. of America, New York.

1,215,865 — Internal combustion engine. Philip E. Rishel, Washington, D. C., assignor of two-fifths to Solon E. Rose, U. S. navy; Julia R. Rishel, administratrix of said Philip E. Rishel, deceased.

1,215,869 — Internal combustion engine. Adolph Rosner, Bridgeport, Conn., assignor to the Locomobile Co. of America, New York.

1,215,870 — Internal combustion engine. Adolph Rosner, Bridgeport, Conn., assignor to the Locomobile Co. of America, New York.

1,215,905—Submarine life saving and observation device. Thomas E. Burke and Joel R. A. Lindholm, Chicago.

1,215,908—Marker buoy. Lewis A. Carter and Lancelot J. Rector, Hayden, Ariz.

1,216,234—Dam construction. Lars R. Jorgensen, South Berkeley, Cal

1,213,153—Submarine steering apparatus. Andre Citroen, Paris, France, assignor to Societe Anonyme Des Engrenages Citroen, Paris, France.

1,213,233—Adjustable oar lock. Thomas S. Morton, Tuxedo Park, N. Y.

1,213,315—Internal combustion engine. Hugo C. Well, New York, assignor of one-half to Frederick A. B. Meinhardt, New York.

1,213,316—Valve mechanism for internal combustion engines. Hugo C. Well, New York, assignor of fifty-one-hundredths to Frederick A. B. Meinhardt, New York.

1,213,579—Lookout mast for ships. Alfred Bonom, Paterson, N. J.

Harbor Expenditures in the United States

North Atlantic Ports

Port	Tonnage	Value	Spent by State, Municipality or Corporations	Spent by Federal Government
Boston, Mass.	2,426,428	$ 241,288,667.68	$ 15,000,000.00	$12,010,201.24
Bridgeport, Conn.	1,039,398	67,003,507.55	.....	974,254.66
Fall River, Mass.	1,426,853	49,880,290.87	.....	365,978.17
Hartford, Conn.	559,728	35,193,842.88	121,384.18	848,905.47
New Bedford, Mass.	1,460,784	43,354,028.60	.....	696,801.52
New Haven, Conn.	1,704,854	105,459,519.16	30,000.00	2,288,805.17
New London, Conn.	824,095	102,871,515.53	1,000,000.00	173,462.96
New York, N. Y.	90,000,000	6,000,000,000.00	130,000,000.00	14,126,281.27
Philadelphia, Pa.	24,817,952	1,033,229,869.00	.....	19,185,496.62
Portland, Me.	2,797,760	117,901,294.00	.....	1,811,030.30
Providence, R. I.	4,104,409	254,014,508.43	2,000,000.00	2,825,202.54

South Atlantic Ports

Port	Tonnage	Value	Spent by State, Municipality or Corporations	Spent by Federal Government
Baltimore, Md.	13,425,185	$ 383,401,736.00	$ 12,750,000.00	$ 9,098,040.68
Brunswick, Ga.	487,224	38,373,320.00	2,500.00	1,398,441.36
Cape Charles, Va.	2,780,352	116,395,251.00	Considerable; no record	144,918.84
Charleston, S. C.	919,184	46,800,741.00	.....	5,149,995.64
Jacksonville, Fla.	1,102,939	46,049,003.00	.....	848,905.47
Newport News, Va.	5,638,589	181,252,300.00	.....	173,462.96
Norfolk, Va.	19,848,658	1,084,106,750.00	.....	3,547,803.76
Richmond, Va.	452,950	32,813,455.00	1,044,476.65	3,199,092.06
Savannah, Ga.	2,478,535	349,193,325.00	9,556.00	10,241,200.85
Washington, D. C.	812,284	11,321,910.00	.....	3,462,965.74
Wilmington, Del.	363,199	63,396,957.04	20,707.22	1,482,122.44
Wilmington, N. C.	792,304	28,682,163.25	.....	5,974,868.48

Gulf of Mexico

Port	Tonnage	Value	Spent by State, Municipality or Corporations	Spent by Federal Government
Galveston, Tex.	5,019,794	$ 451,985,152.00	$	$11,392,040.40
Houston, Tex.	1,070,700	24,382,700.00	1,252,923.61	6,058,555.06
Mobile, Ala.	2,392,442	58,085,903.00	151,261.00	7,322,362.33
New Orleans, La.	6,273,012	311,557,861.00	7,500,000.00	9,489,931.35
Pensacola, Fla.	1,164,502	22,819,119.00	400,000.00	1,356,818.15
Port Arthur, Tex.	9,650,382	142,009,956.00	8,800.00	5,514,307.15
Tampa, Fla.	2,083,674	36,034,985.00	.....	789,090.47
Texas City, Tex.	301,106	32,020,182.00	483,670.17	1,456,361.33

Pacific Coast Ports

Port	Tonnage	Value	Spent by State, Municipality or Corporations	Spent by Federal Government
Los Angeles, Cal.	1,734,752	$ 76,696,764.00	$ 4,539,381.00	$ 3,376,039.06
Oakland, Cal.	2,608,402	196,114,563.00	1,022,804.19	4,238,832.49
San Louis, Cal.	2,280,319	10,355,955.00	.....	568,418.08
Portland, Ore.	8,043,263	100,018,293.00	5,863,000.00	3,577,958.35
Sacramento, Cal.	721,090	38,211,760.00	3,950,000.00	1,137,532.09
San Diego, Cal.	654,087	60,184,675.00	800,445.00	1,017,788.81
San Francisco, Cal.	9,907,549	554,063,227.00	45,000,000.00	571,052.19
Seattle, Wash.	3,162,625	157,465,293.00	5,570,812.58	2,234,874.97
Stockton, Cal.	772,156	35,479,741.00	.....	690,579.55
Tacoma, Wash.	1,434,168	64,710,679.00	.....	324,784.10

American Great Lakes Ports

Port	Tonnage	Value	Spent by State, Municipality or Corporations	Spent by Federal Government
Ashland, Wis.	4,432,452	$ 11,126,078.00	$	$ 600,674.42
Ashtabula, O.	11,833,302	29,529,689.00	384,000.00	2,271,919.56
Buffalo, N. Y.	14,896,302	357,977,074.00	8,162,058.43	6,145,010.05
Rochester, N. Y.	950,279	2,895,415,00	.....	904,722.92
Chicago, Ill.	3,780,509	242,620,046.00	5,000,000.00	4,593,744.37
Gary, Ind.	1,907,178	5,000,000.00	2,308,303.87	.....
Cleveland, O.	10,912,572	50,979,660.00	3,790,000.00	7,503,270.45
Conneaut, O.	8,625,166	25,064,766.00	.....	1,447,050.57
Detroit, Mich.	69,810,853	800,032,275.00	5,000.00	11,892,246.44
Duluth-Superior	33,535,704	287,002,960.00	182,433.26	7,524,816.78
Erie, Pa.	3,014,344	67,508,612.00	3,160,000.00	1,502,113.36
Escanaba, Mich.	.....	.....	.....	.....
Fairport, O.	2,454,304	12,816,270.00	50,000.00	1,113,965.48
Grand Haven, Mich.	645,804	49,331,673.00	.....	1,049,479.91
Huron, O.	1,407,355	3,790,343.00	84,000.00	573,883.62
Lorain, O.	4,507,075	11,517,228.00	550,000.00	1,144,160.00
Ludington, Mich.	1,510,437	53,408,710.00	.....	1,593,485.64
Manitowoc, Wis.	1,742,860	106,412,333.00	.....	912,520.64
Marquette, Mich.	794,543	3,016,511.00	.....	854,935.60
Milwaukee, Wis.	8,484,829	152,870,899.00	1,888,941.37	2,380,049,39
Ogdensburg, N. Y.	959,648	57,505,133.00	.....	530,412.58
Sandusky, O.	3,129,776	12,778,376.00	16,000.00	1,286,276.92
South Chicago, Ill.	6,549,576	162,000,344.00	.....	1,595,144.57
Sheboygan, Wis.	637,679	9,331,213.00	.....	893.589.83
Toledo, O.	7,166,172	22,286,168.00	300,000.00	3,089,011.72
Tonawanda, N. Y.	521,638	8,880,909.00	.....	661,323.23
Two Harbors, Minn.	6,668,005	16,129,988.00	1,800.00	262,356.30
Racine, Wis.	221,125	6,197,179.00	.....	812,062.26
Kenosha, Wis.	78,641	4,259,746.00	.....	583,839.30
Two Rivers, Wis.	38,579	169,043.00	.....	356,091.27
Green Bay, Wis.	898,008	9,974,607.00	.....	600,694.02
Menominee, Mich.	447,728	8,542,684.00	25,000.00	443,776.37
Manistique, Mich.	251,296	4,691,877.00	.....	316,194.48
Oconto, Wis.	2,811	94,515.00	25,000.00	144.647.24

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Purifying Drinking Water on Ships

A Discussion of the Different Methods of Safeguarding the Water Used for Drinking and Cooking Purposes With Special Reference to the Great Lakes

By J. Forbes

AN impression prevails in this country that we are ahead of European countries in matters of sanitation. In order to contradict this the following quotation is made from an article by Dr. Allen J. McLaughlin, of the public health and marine hospital service:

"The excessive prevalence of typhoid fever in the United States has been characterized, and not without reason, as a national disgrace. Certainly that portion of our typhoid prevalence which is due to polluted water supplies is preventable, and our failure to prevent does not redound to our credit. In northern Europe, the 33 principal cities, with an aggregate population of 31,500,000, had an average typhoid rate per 100,000 population of 6.5 in 1909 and 1910. The 50 largest cities in the United States, with an aggregate population of over 20,000,000, had an average typhoid death rate in 1910 of 25 per 100,000 inhabitants."

Water—Cause of Typhoid

Authorities are practically unanimous in stating that 85 per cent of all typhoid cases are caused by water, and they attribute the remaining 15 per cent to "lack of control" of typhoid cases, "ignorance" of those in contact with typhoid cases, "insects" and similar factors connected with existing typhoid cases. If these statements are analyzed it is manifest that if the 85 per cent of cases did not exist then the 15 per cent generated from them would not exist, and, the logical conclusion must be that all typhoid is traceable to water.

Aside from water of exceptional softness, the character of water would not be a modern issue were it not for its pathogenic (disease producing) content, for it is now generally acknowledged by leading sanitarians and investigators that far from being detrimental both the mineral elements in solution and the harmless bacterial content of all ordinary water supplies are actual advantages; for the former, by replacement, prevents demineralization of the human organism, and the latter, by competition, keeps within normal bounds the necessary microbic element in the healthy human system.

The water of the Great Lakes having a wholesome content of mineral salts, it is therefore only the pathogenic organisms which are to be dealt with, and the matter at issue is their destruction.

There are a number of features surrounding the practice of water purification, and particularly the methods employed for ascertaining and rating its efficiency, that are so misleading that they are in no small measure responsible for the lack of expected results. Two seem to be predominant:

1. The extraordinarily small volume unit used in measuring bacterial content, the cubic centimeter.
2. The generally accepted permissible allowance of organisms in the effluent water. This permissible allowance is commonly stated at not more than 100 organisms per cubic centimeter at any time while the average should be 20 or under.

Respecting the first of these factors, while the cubic centimeter may be the acceptable laboratory unit, it has no practical bearing upon the everyday use of water by human beings. The ordinary drinking glass in common household use has a content of 8 ounces or somewhat over 236 cubic centimeters. In reducing the cubic centimeter bacterial content to practical use, it must be multiplied by 236. When this is done, a fair idea may be gained of the number of bacteria that will be taken into the human system in a single glass of water, not to mention the number of glasses of such water the average individual will consume in the course of a day.

With the above in mind even the average permissible contents of 20 organisms per cubic centimeter will at once disclose sufficient reason for the failure of purification, especially in times of peril existing in the natural water supplies, for it must be remembered that this average permissible bacterial content is a flat statement and covers bacteria of both benign or harmless and pathogenic or disease-producing character.

While the permissible number of bacteria per cubic centimeter is a vastly more intelligent and superior method than that of specifying a given per cent of bacterial reduction, nevertheless the number of bacteria stated as permissible is vague especially as there is no distinction made between benign and pathogenic organisms. If it is only intended to cover benign organisms then there is no necessity for limiting the number to 20 or even to 100 for the natural process of breathing takes in harmless bacteria far in excess of this number every hour; on the other hand, if it is intended to cover pathogenic organisms then there should be no organisms permissible.

Respecting the commercial guarantee of apparatus to remove 98 or even 99 per cent of the bacteria, much depends upon the proportion between harmless and pathogenic bacteria and the total number of organisms in the raw water. In matters bacterial the numbers of organisms are so enormous that such percentages of elimination as 98 and 99 are meaningless. In time of water-borne peril, efficiencies of 99 and even 99.99 per cent fall wide of the mark for it must be remembered that it does not require, under favorable conditions, more than a single organism to transmit a dreaded disease.

Means of Water Purification

For purposes of classification all the present methods of purification may be broadly grouped under two general headings:

(a)—Applicative methods.
(b)—Conditional methods.

Considering the latter, conditional methods may be said to be those in which the complete action of the agent itself is made the sole condition upon which the water under treatment can pass through the apparatus, and this too without the intervention of any other or extraneous agent. In other words a true conditional method is one in which the agent of purification is the motive power which causes the water to pass through the apparatus. An accidental stoppage of the agent, or a change in the organic burden of the water under treatment, therefore, has no effect on the result obtained by the treatment.

A truly conditional method of water purification calls for something more than a mere purifying agent. The agent must possess an active immutable characteristic which may be made use of in producing some physical change, or bringing about

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some natural phenomenon. Such changes or phenomena are basic in nature and therefore invariable; hence they can be relied upon always to do exactly the same thing under the same conditions.

For example, an immutable characteristic of water is that it seeks its own level and will not naturally run up hill. A further phenomenon of water is that when it is heated to a certain temperature throughout its entire body it will boil. Boiling is an active tangible condition of which use may be made, for when water boils it will rise above its own level and run up hill in a liquid state, just as a pot boils over on the kitchen stove.

If the water is kept boiling the entire body will be finally changed into steam and use may also be made of this natural phenomenon. Now pathogenic water-borne organisms being composed of albumen are coagulated and invariably destroyed at a temperature far below the boiling point of water. It is but an easy and short step now to take advantage of the immutable phenomena above mentioned. In the case of the former, a weir or dam may be used so that when the water boils (but not before) it will have to rise to pass over the weir. This is sterilization. In the case of the latter, the steam may be led to a chamber and condensed back into a liquid state again. This is distillation. It will be observed that in both these cases, the water must be heated above the lethal or destructive temperature of pathogenic bacteria before the natural phenomenon occurs, and the act of destroying the bacteria, or purification, is inseparable from the movement or passage of the water through the purifier.

The above are truly conditional methods of purification.

In conditional heat sterilization only the pathogenic bacterial content of the water is destroyed; the mineral composition of the water is not changed and the taste or potability of the water is never destroyed and in some cases it is even improved. Again the content of beneficial and harmless bacteria is not changed. Beyond all this also sterilized water possesses a natural resistance to recontamination. These conditions are important in considering lake water where the pathogenic content only is the issue.

A factor equally as important as the bacterial and chemical character of the water itself is the continuous maintenance of this character. A water supply to be really safe must be safe 365 days in each year. It is not sufficient or to the purpose that the water supply be safe "most of the time" or even 364 days of the year. If unsafe even for a very short time, an epidemic of sufficient proportions to undo all the good of the rest of the year, may be initiated.

Briefly, then, safe water is therefore that which for 365 days in each year has all the essential minerals, has none of the pathogenous or disease-producing micro-organisms or bacteria; and from an aesthetic point it may also be clear, but this feature is insignificant compared with the others.

Pumps for Water Purifying Systems

The Union Steam Pump Co., Battle Creek, Mich., advises that it has already sold more than 100 small pumps for use on lake boats in connection with water purifying systems. The company manufactures two sizes of steam-driven, duplex, boiler-feed pumps, both of which are designed to handle the requirements of such systems.

The sizes in which these pumps are made are 2½ x 1½ x 3 inches, and 3 x 2 x 3 inches. These pumps are of standard duplex design with all four cylinders in one casting. All parts are interchangeable. No gaskets are used except on heads and chests. The steam cylinders are double ported. The steam pistons are cast solid, each being equipped with two expanding rings. All valve gear parts are steel or malleable iron. Motion is transmitted from the piston rod by a machined collar. This collar has hexagon for wrench so that the piston rod can be held without straining valve gear parts when tightening piston rod nuts. Each pump is tested at the plant, and is required to meet 50 per cent excess pressure at full speed on a half-day run before being passed. The pumps are 22¼ and 23½ inches long respectively, 8¼ and 8¾ inches wide, and 11¼ and 12 inches high. The smaller pump weighs 100 pounds, the larger 115 pounds. The former has a capacity of 360 gallons per hour at full speed of 150 strokes per minute, while the larger pump has a capacity of 700 gallons per hour.

High Peace Rates

"If I had a million dollars, I would invest it in chartered ships at the end of the war," was the comment recently of the agent of an important South American shipping company on conditions which are likely to follow peace. "It seems to me that there will be a very sharp break, following which an upward revision will occur that will carry rates far above normal. I think that the time charter rate will decline from its present inflated level to six or seven shillings on boats for 12 months and that the advance will carry it up again to perhaps 14 or 15 shillings. It is unreasonable to suppose that there will be any enormous demand for tonnage during the first month or two after the war. This will not become apparent until the work of reconstruction gets well under way."

Ships Bring High Prices

The record of ship sales during the last quarter of 1916, as compiled by Lloyds list, emphasizes the high prices still ruling. For instance, the steamer HERCULES, sold in 1916 for £260,000, was sold in 1915 for £85,000, and changed hands in 1904 at the price of £32,250. She cost £42,000 to build in 1903. ASKELAD, sold in 1916 for £138,500, was sold in 1912 for only £14,500. DEMETRIOS INGLESSIS, sold in 1916 for £80,000, was worth only £7,000 in 1911. PLUTON, sold in 1916 for £66,000, was sold in 1915 for £11,000. SANTA EUGENIA, sold in 1916 for £32,000, was sold eight years ago for only £4,800.

The following table shows steamers of 3,000 tons dead weight or more the sale of which was recorded during the period covered:

Name	Tons, dead weight	Built	Price £	Rate per ton £ s
Rose Castle....	11,000	1915	142,500	12 19
Lord Strathcona	11,000	1915	142,500	12 19
New steamer...	10,000	1916	200,000	20 0
Hackness	8,500	1914	225,000	26 9
New steamer...	8,200	1916	340,000	41 9
New steamer...	7,800	1916	200,000	25 12
Hawkhead	7,700	1912	165,000	21 8
Swanley	7,600	1903	150,000	19 14
Inverkip	7,000	1908	140,000	20 0
New steamer...	7,000	1916	145,000	20 14
Hercules	6,600	1903	260,000	39 7
Arthur Balfour.	6,500	1903	100,000	15 7
Lamington	6,200	1907	150,000	24 3
La Marseillaise.	6,200	1900	250,000	40 0
Susana	5,950	1897	220,000	36 13
Garryvale	5,950	1907	87,500	14 11
Yamato Maru..	5,800	1894	175,000	30 3
Rachel	5,550	1910	130,000	23 12
Jos. W. Fordney	5,500	1901	205,000	37 5
Gozan Maru....	5,500	1898	175,000	31 16
Portreath	5,400	1907	95,000	17 11
Lynton	5,200	1899	63,000	12 2
Meikai Maru...	5,200	1916	205,000	39 8
Buxton	5,200	1906	80,000	15 7
Kifunezan Maru	5,100	1916	200,000	40 0
Yesaki Maru...	5,000	1916	193,000	38 12
Sildra	5,000	1904	200,000	40 0
Etton	4,910	1905	75,000	15 5
Kaifuku Maru..	4,900	1892	150,000	30 12
Ethelhilda	4,870	1897	65,000	13 7
Grelford	4,850	1898	75,000	15 9
Askelad	4,600	1894	138,500	30 2
Miaoulis	4,450	1893	118,500	26 12
Temiya Maru..	4,400	1894	105,000	23 17
Lucincita	4,275	1890	34,200	8 0
Bygland	4,000	1905	186,000	46 10
Merannio	3,600	1891	45,000	12 10
New steamer...	3,500	1916	110,000	28 11
Santos	3,500	1890	100,000	28 11
Ramleh	3,500	1891	50,000	14 5
Helsingborg ...	3,500	1900	105,500	30 1
Greatham	3,500	1890	45,000	12 17
Petra	3,500	1912	183,500	52 8
New steamer...	3,300	1916	99,000	30 0
Magnus Mail...	3,250	1889	48,500	14 18
Antares	3,150	1908	133,500	42 7
Demetr's Inglessis.....	3,100	1891	80,000	26 16
Plata	3,000	1890	135,000	45 0

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England's Yankee-Built War Boats

Fleet of 80-Foot Power Craft Proves Effective Against German Submarines — Elco Official Tells Story to U. S. Navy Department

By Robert E. Power

The sea-keeping qualities of these little giants cannot be overestimated. During one great Channel storm, two of these tiny boats patrolled the raging waters ceaselessly for forty-eight hours, encountering mountainous seas and winds that blew hurricanes, yet both put safely back to port, unsuccessful in their quest, but in good shape. Not a plank was started; not a stay was loose; not a drop of water was in their bilge holds. And during that same storm, larger and supposedly more seaworthy craft found their way to the slimy ooze and sticky chalk of the Channel bottom.—New York Sun.

GREAT Britain's most effective weapon against the German submarine is a little 80-foot power boat, Yankee-designed and built and shipped on steamers across the Atlantic. The Elco Co., of Bayonne, N. J., constructed, tested and delivered 550 of these 80-footers in less than 550 days, the contract price being $40,000.00 each, or $22,000,000. The last boat was delivered Oct. 31, 1916. These facts were laid bare to the navy department officials at Washington recently by Henry R. Sutphen, vice president and general manager of the Elco Co., well-known builders of high-grade runabouts and cruisers for pleasure purposes. With the prospect of war with Germany imminent, the government sent for Mr. Sutphen to find out what England did to protect the British Isles from submarine attack. We have known in a hazy way that they have built and commandeered many small power boats, but details have been lacking. We do know, however, that their methods of defense have been successful; no German submarine has approached Great Britain's coast and returned to tell the tale. "Our first contract with Great Britain was for 50 boats," says Mr. Sutphen. "Although we don't know just what they did with them, because the British admiralty will not disclose any results, we do know that soon after the first of them had been delivered and put to work, the British sent over a rush contract for 500 more just like the first 50, and we finished and delivered the last of the batch on Oct. 31, last, although the contract did not call for the delivery of the entire outfit until Dec. 15. The English declared all along that it would be a physical impossibility for us to do the work on time, but we finished six weeks ahead of time, and in less than 550 days after getting the first contract. After we really got under way we turned the boats out at the rate of three a day.

"We are now making a smaller lot of the chasers for another European government, one of the Allies, and we could add to that contract, another from the United States, and start on it tomorrow at a three-boat-a-day rate of completion. This is possible because we have standardized everything in the craft from the keel up. The size of the British contract enabled us to standardize more thoroughly than had ever before been possible in boat building. The industry became as much a matter of making and assembling uniform parts as is the

HOW GREAT BRITAIN HAS PROTECTED ITS COAST AGAINST THE DEADLY GERMAN U-BOAT

Power boats with 20 knots speed and rapid fire guns.
Aeroplanes for patrolling and observing.
Mines and nets in harbors and fairways.

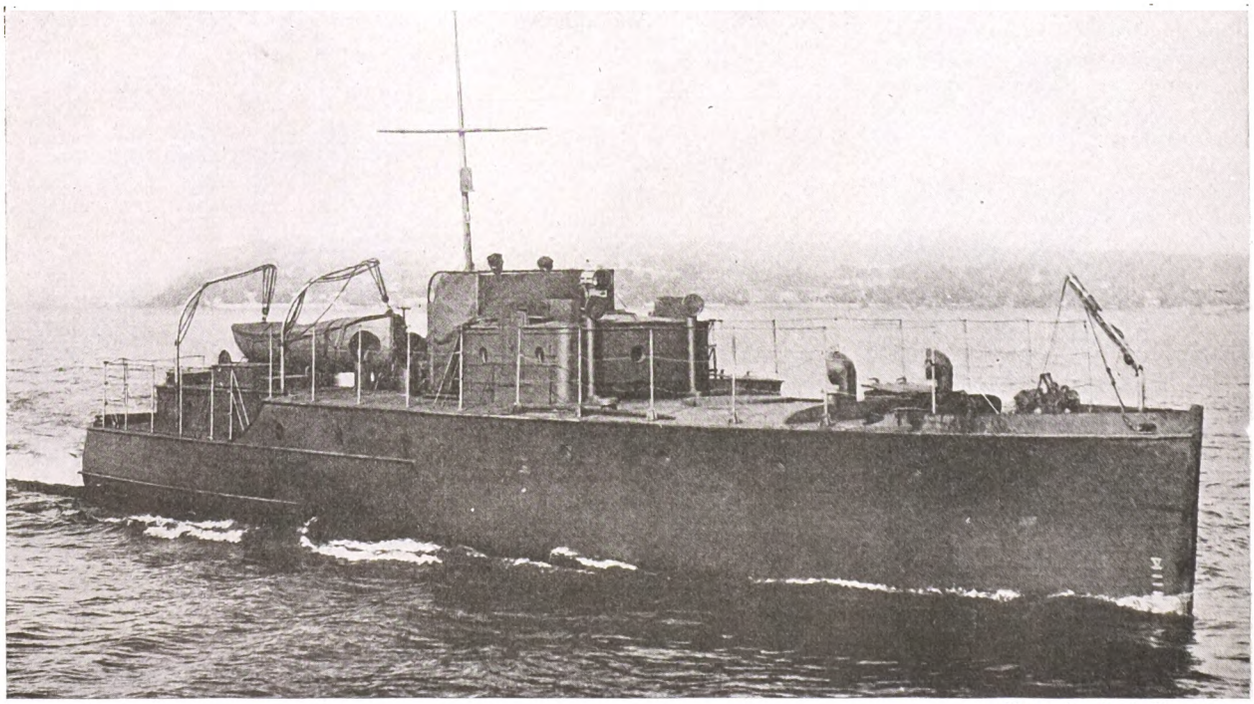

Photo by Paul Thompson.

SUBMARINE CHASER, DESIGNED AND BUILT BY THE ELCO CO. FOR THE BRITISH GOVERNMENT, BEING TESTED OFF THE JERSEY SHORE. THESE BOATS ARE 80-FOOT LENGTH, 32-TON DISPLACEMENT, 500-HORSEPOWER, AND HAVE A CRUISING SPEED OF 19 KNOTS. THIS PHOTO SHOWS THE BOAT COMPLETE EXCEPT ARMAMENT, WHICH IS INSTALLED IN ENGLAND

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construction of large numbers of automobiles. Because of that we produced those 550 boats for England at a cost of about $40,000 apiece. Since that contract was taken, labor and material have increased in price about 30 per cent. If we were going to do business with the United States government now on a strictly business basis the cost of the same type of boat would be about $50,000 apiece.

"This submarine chaser of ours was designed by Irwin Chase, the naval architect of the company, after I had told him what the boat must be able to do on patrol and locating and chasing submersibles. Simply because we had, through our parent company, the Submarine Boat Corporation, done our best in making the submarine itself effective, we had some ideas of our own as to the best sort of a boat to cope with the submarine and put it out of business.

Dimensions of the English War Boats

"The chaser is a boat of 32 tons, 80 feet long, with a beam of 12½ feet, and she draws only 4½ feet. It is in her shallowness that we have our chief protection against the torpedo of the submarine she is competing with. Torpedoes are arranged to travel much further under water than 4½ feet, partly to make sure of striking the vulnerable part of a big ship's hull and partly because a torpedo is not manageable unless moving through solid water. If it gets too near the surface, especially when there is a heavy sea, a part of it at least is apt to get above the surface and then there is no telling what direction it will take.

"Each boat is equipped with two gasoline engines of 250-horsepower each, turning 450 revolutions a minute. With this power, low enough to be reliable under all sea and weather conditions, we get a speed of 19 knots an hour. And the boat can travel at that maximum rate for 650 nautical miles. She can travel a thousand sea miles at 15 knots an hour. Her fuel tank capacity is 2,200 gallons.

"Each boat is equipped with a 3-inch rapid-fire gun, firing 20 shots a minute. One shot from these boats, if it hits the hull, will sink the submarine; that's why they are so much feared by the German U-boat commanders. They are so fast and can be maneuvered so rapidly that the English call them their "sea-wasps". A fleet of them protecting our harbors would make the United States impregnable against U-boat attack.

"The speed of the German submarine of the U-boat type, many of which would be available for hostile operations along the east coast of the United States, is only 16 knots. That would give the chaser a margin of 3 knots an hour in pursuit. Aside from its torpedoes the German U-boat carries at least one 4-inch gun, with which she could hammer any town on our coast. Or she could torpedo the boats in our harbors and practically institute a blockade that would close our ports to commerce.

"Of course our coast fortifications would be no protection against such a craft, for it could simply dive and stay under till within easy shooting distance for herself and entirely out of range of our coast defense guns, which have only a seaward range. The U-boat, for example, would have no difficulty in coming by Sandy Hook and the forts at the Narrows into the upper bay and the rivers themselves and taking pot shots at big boats in the harbor and buildings on Manhattan. She could dive by Fort Wright and attack New London from the Thames river where no coast gun could touch her. And so on, all up and down the coast. No city is safe from this new form of boat attack with our present equipment for defense.

"If we had chasers on this coast, they should operate in small fleets or packs, with 20 or 25 boats in a group and each lot doing hunt and patrol duty with an important harbor as its headquarters and rendezvous. In that way every city and town would be protected. It may seem out of proportion to have so many boats on guard against a single submarine, but it is not so in reality. Remember that the chasers cost $40,000 apiece, and can be turned out at the rate of three a day. The 800-ton German U-boat costs a million and a half, takes a long time to build, and the damage it could do to a port in a very short while would far exceed the value of a fleet of chasers."

It would be quite possible for the United States government to order and have delivered ready for service 1,000 wooden war boats of the same size and speed of the English craft in 12 months time. The hulls could be standardized and there are 10 large boat building firms and five engine manufacturers that have facilities for taking over such a contract and carrying it out successfully without embarrassing any other mobilization plans of the government.

Tug PAUL JONES, largest vessel of its type ever built for towing on the seaboard, has left for France with a loaded barge in tow. She will be employed as an auxiliary in French navy.

The Oregon Shipbuilding Co., Portland, Ore., has secured contracts to build three wooden motorships. The work will be done under the supervision of J. H. Price, who recently designed and built CITY OF PORTLAND. The concern is capitalized at $200,000.

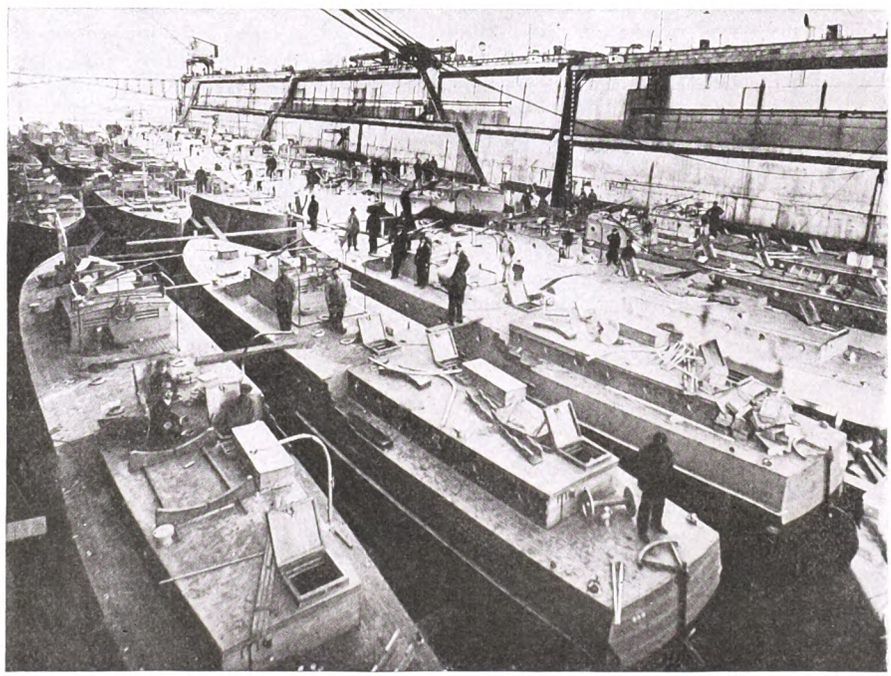

Photo by Paul Thompson.

SCENE IN THE ELCO PLANT, BAYONNE, N. J., WHERE A LARGE PART OF THE 550 SUBMARINE CHASERS, 80 FEET LONG AND 12-FOOT BEAM, ORDERED BY THE BRITISH GOVERNMENT, WERE COMPLETED AND DELIVERED IN 550 DAYS. EACH BOAT IS EQUIPPED WITH TWO STANDARD SPECIAL ENGINES OF 250-HORSEPOWER EACH

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In the Traffic Manager's Office

A Review of the Month on Coasts and Lakes—Useful Pointers for the Men Who Get the Business

61 Concerns Control British Shipping

THE growing trend toward centralization of control in British shipping is well illustrated by the fact that 61 companies, each owning more than 50,000 gross tons of ships, own between them more than 2,000 vessels, representing a tonnage of 12,000,000 gross tons, while Lloyds Register gives the total tonnage of the British mercantile marine at only 18,825,356 gross tons. Combinations which occurred last year brought considerable additions to already large fleets. The Peninsular & Oriental Steam Navigation Co., owning with the British India Line 1,187,311 gross tons, acquired control of the New Zealand Shipping Co. with 146,140 gross tons and the Federal Steam Navigation Co., with 195,372 tons, giving a gross total of 1,528,823 tons, according to *Syren and Shipping*. The million-ton mark is also passed by the Ellerman Lines, Ltd., whose total is 289 vessels, of 1,310,362 tons. Included in these figures is Sir John Ellerman's latest acquisition — the Wilson Line, of Hull whose fleet consists of 80 vessels, of 217,524 tons; the Ellerman & Bucknall Steamship Co., 28 vessels, of 132,244 tons; the City Line, 43 vessels, of 274,131 tons; the Ellerman-Hall Line, and others. Just under the million mark are the Furness Lines, with 220 vessels, of 920,424 tons, which include the Prince Line fleet of 39 vessels, of 181,211 tons. If we bracket these three amalgamations, we get a total of 3,359,443 tons of shipping, which equals about 18 per cent, or very nearly one-fifth of the total British mercantile marine under the control of three managements.

But very little different is the position of the Royal Mail Steam Packet Co. Its fleet consists of 53 vessels, of 331,081 tons. The fleets of the Pacific Steam Navigation Co., Elder Dempster, Union-Castle, Nelson Line and Lamport & Holt, which companies are closely affiliated with the management of the Royal Mail, represent a gross tonnage of 1,223,294 tons, or, grouping the whole of these companies, the total tonnage controled is 1,554,375 tons.

The building program of the 61 companies, listed as owning at least 50,000 tons, shows that they have on order collectively 170 ships aggregating approximately 1,365,286 tons. The Furness Lines head the list with 29 steamships, representing 163,512 tons, which are being built for the various companies that they control. Ellerman lines have 25 vessels building, aggregating 145,900 tons gross; the Wilson Line has contracted for 10 ships of 39,915 tons. The British India Line has five new vessels ordered, aggregating 35,900 tons; while the P. & O. have four ships under construction, two of 13,800 tons each and one of 15,620, and one of 16,230 tons, all larger than any of the ships now owned by the P. & O. Other companies have smaller amounts of tonnage building.

The table on page 133 lists the number of vessels and tonnage owned by the 61 leading British companies on Jan. 1, 1917, compared with the vessels and tonnage owned on Jan. 1, 1916.

Protest Rates on Steel

In view of the large ship building contracts pending and the enormous advance in the cost of labor and materials, a complaint recently laid before the interstate commerce commission by the Newport News Shipbuilding & Dry Dock Co., Newport News, Va., against the rate on certain iron products from the Pittsburgh district proves highly interesting. This ship building company charged that the railroads are discriminating against it in favor of some other eastern ship building companies. The commisssion was requested to investigate the situation and to enter an appropriate order.

The Newport News company stated that it is a regular purchaser of steel plates, bars, channels, angles and such commodities which are used in the construction of ships. The company claimed to use at least 500 carloads of such products yearly, these cars having an average tonnage of 70,000 pounds each. The shipments are made from Bessemer, South Duquesne, Clairton, Allegheny, Munhall and other stations located in the so-called Pittsburgh district, to Newport News. The rate charged on such shipments has been and is 21.3c per 100 pounds, which the company claims to be excessive.

In comparison it was cited that the rate from the Pittsburgh district to New York on the same commodities is 16.9c per hundred pounds. The company declared that the rate to Newport News should not exceed the rate contemporaneously charged to New York and that reparation should be made it upon this basis on all the shipments made within the past two years. This demand was made largely upon the consideration of the mileage and the value of the traffic.

The Pennsylvania and other railroads engaged in this traffic east of the Mississippi river were named defendants to the complaint. This petition as filed with the interstate commerce commission is of special significance in view of the present boom conditions in the ship building industry. It is the first time that an eastern ship building company has petitioned the commission for lower rates since this boom began. The western ship building companies joined in a protest to the commission some time ago against the large advance proposed by the roads in the transcontinental rates on iron and steel articles, which the roads proposed in view of the cessation of water competition between the coasts through the Panama canal.

The Newport News company expects to enter into contracts with the navy department shortly for the construction of a large part of the tonnage which is to be built under the new building program. The freight rates from the Pittsburgh district to Newport News is, consequently, of great importance not only to the ship building company but also to the government.

The navy yard at New York is likewise interested in the rates on these commodities and would be unwilling to see the New York rate raised in order to remove any alleged discrimination

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with Newport News. Consequently the tendency is felt to be toward lower rates on the commodities.

If the railroads are persuaded to reduce the Newport News rate it would mean a corresponding reduction in the freight rates on iron and steel articles to the eastern ports.

Will Study Oriental Port Facilities

A study of the existing and proposed port and transportation facilities of Russia and the Far East has been undertaken by the bureau of foreign and domestic commerce, of the department of commerce. Paul Page Whitham, consulting engineer, Seattle, has been selected for the work, and an itinerary has been decided on which will include Russia, China, Japan, Philippines, French China, Federated Malay States, East Indies, Burma, India and Australasia.

The investigation will cover ports and their equipment, the railways, canals and river navigation, as well as intelligence communication facilities. The first object is to provide ship owners or operators and those interested in foreign trade full and reliable information in regard to the port and transportation facilities of the countries visited. The information is to be such that the shipper may determine the ports through which he can most advantageously reach certain territories and the best routing from there on to destination. In this connection there will be furnished descriptions of the methods of handling goods in the various stages of the journey.

The second object of the investigation is to get together reliable information on proposed transportation extensions and improvements, particularly in China and Asiatic Russia. Such information, the bureau thinks, will be of great value to American investors, engineers, contractors, manufacturers and dealers in port, railway and other transportation equipment.

The third object of the proposed study is to supply data and suggestions to American port authorities, engineers and transportation men generally.

Mr. Whitham will visit a number of cities in this country before going to the Far East and expects to confer with shipping men, engineers and contractors, investment bankers, exporters and trade organizations, manufacturers of freight-handling facilities, and others who are interested in the investigation. He expects to be abroad about two years.

These Concerns Own 65 Per Cent of Great Britain's Merchant Fleet

BRITISH FLEETS OF OVER 50,000 TONS GROSS.

Lines	—Jan. 1, 1917— No. of vessels	Gross tonnage	Avge. size	—Jan. 1, 1916— No. of vessels	Gross tonnage	Avge. size	NUMBER AND TONNAGE OF VESSELS BUILDING (INCLUDED IN PREVIOUS TOTALS.)
1—Ellerman Lines, Ltd	139	699,383	5,031	133	633,990	4,767	1—25 of 145,900 tons.
2—British India	143	693,320	4,849	145	700,318	4,830	2—5 of 35,900 tons.
3—Alfred Holt & Co	84	569,094	6,775	84	561,339	6,683	3—4 of 33,000 tons.
4—Furness Line	143	560,261	3,018	118	462,554	3,920	4—25 of 153,262 tons.
5—P. & O. Co	59	493,991	8,373	62	517,578	8,348	5—2 of 13,800 tons each, 1 of 16,230 tons and 1 of 15,620 tons.
6—White Star Line	26	403,347	15,513	27	434,039	16,075	6—2 of 42,550 tons each.
7—Union Castle Line	48	387,136	8,065	49	355,275	7,250	7—4 of 15,000 tons each and 1 of 4,500 tons.
8—Royal Mail Steam Packet Co	53	331,081	10,032	55	337,439	6,135	8—1 of 8,400 tons.
9—Cunard Line	30	325,343	10,844	24	300,000	12,500	9—1 of 14,500 tons.
10—Elder Dempster & Co., Ltd	90	315,924	3,510	92	309,218	3,361	10—5 of 6,700 tons each.
11—Leyland Line	47	295,538	6,288	48	301,763	6,287	
12—Clan Line	62	292,505	4,717	59	272,407	4,617	12—10 steamers building.
13—T. & J. Harrison	53	281,808	5,317	55	288,497	5,245	13—6 of 36,000 tons.
14—City Line	43	274,131	6,375	47	288,030	6,128	14—1 of 7,000 tons.
15—Lamport & Holt, Ltd	39	223,473	5,730	55	252,992	4,598	15—Steamers building, 73,080 tons dw.
16—Thos. Wilson, Sons & Co., Ltd	80	217,524	2,719	73	197,480	2,705	16—10 of 39,915 estimated gross tonnage.
17—Eagle Oil Transport Co., Ltd	24	215,671	8,986	19	148,922	7,838	17—6 tank steamers of about 12,000 gross tons each.
18—Shaw Savill & Albion Co	21	203,521	9,691	20	191,680	9,584	18—5 of 54,000 tons.
19—Pacific Steam Navigation Co	35	199,310	5,695	41	211,058	5,147	19—1 of 15,600 tons and 1 of 6,000 tons.
20—Federal Steam Navigation Co	22	195,372	8,880	15	129,290	8,619	20—9 of 9,000 tons each and 1 of 10,650 tons.
21—Lane & Macandrew	39	191,882	4,920	18	70,331	3,907	21—5 of 30,000 tons approximately.
22—C. P. R. Ocean Steamship Lines	19	183,123	9,638	18	180,286	10,016	22—6 of 103,000 tons.
23—Prince Line	39	181,211	4,646	39	154,316	3,957	23—4 of 10,250 tons.
24—Houlder Line	38	178,952	4,709	40	186,750	4,668	24—1 of 8,800 tons.
25—Allan Line	16	155,670	9,730	17	156,670	9,212	
26—New Zealand Shipping Co	16	146,140	9,134	16	143,272	8,954	26—1 of 10,000 tons.
27—Sir R. Ropner & Co., Ltd	40	144,843	3,621	45	159,769	3,550	
28—Anglo-Saxon Petroleum Co., Ltd	34	137,555	4,045	36	151,159	4,119	
29—Ellerman & Bucknall S. S. Co., Ltd	28	132,244	4,723	29	136,364	4,702	
30—Atlantic Transport Line	16	129,623	8,101	20	180,727	9,036	30—1 of 15,000 tons.
31—Anglo-American Oil Co., Ltd	29	128,256	4,422	25	119,771	4,791	31—3 building.
32—Anchor Line	17	124,378	7,316	15	114,222	7,615	
33—C. T. Bowring & Co., Ltd	30	114,644	3,821	32	120,231	3,757	33—2 of 5,400 tons and 1 of 3,578 tons.
34—Hain Steamship Co., Ltd	30	113,649	3,788	36	136,142	3,782	
35—Andrew Weir & Co	21	112,934	5,378	32	138,070	4,315	35—1 of 6,051 tons.
36—Booth Steamship Co., Ltd	26	107,722	4,143	26	107,721	4,143	
37—Orient Steam Nav. Co., Ltd	9	105,576	11,731	9	104,577	11,619	37—1 of 15,000 tons.
38—Nelson, H. & W	15	97,451	6,496	14	93,120	6,651	
39—Indo-China Steam Nav. Co	39	93,228	2,390	40	94,887	2,372	
40—Watts, Watts & Co., Ltd	25	92,286	3,691	18	70,244	3,902	
41—Maclay & McIntyre	25	90,974	3,639	34	126,064	3,708	
42—Manchester Liners, Ltd	19	88,980	4,680	17	80,668	4,745	42—2 of 5,700 tons each.
43—Brocklebank, Thos. & John, Ltd	14	88,875	6,348	12	78,033	6,503	
44—Donaldson Bros., Ltd	15	83,556	5,570	17	89,992	5,293	44—2 of about 5,200 tons each.
45—Asiatic Steam Nav. Co., Ltd	18	82,798	4,600	18	82,798	4,600	
46—James Westoll	29	80,912	2,790	32	84,119	2,628	46—1 of 5,000 tons.
47—Dominion Line	9	80,795	8,977	10	82,379	8,238	47—2 of 24,700 tons.
48—Rankin, Gilmour & Co., Ltd	17	80,791	4,754	18	84,823	4,712	
49—Gow, Harrison & Co	15	75,635	5,042	18	88,300	4,905	
50—Bibby Line	9	73,676	8,186	8	62.901	7,862	50—1 of 9,200 tons and 1 of about 10,500
51—Houston Line	18	70,214	3,901	18	70,214	3,900	
52—Larrinaga & Co	15	68,874	4,591	15	68,090	4,540	
53—Hogarth & Sons	20	62.906	3,145	25	84,944	3,398	
54—Head Line	18	60,661	3,370	18	56,982	3,165	54—2 of 5,350 tons each.
55—Petersen & Co., Ltd	17	58,767	3,457	13	52,750	4,058	55—2 of 3,600 tons.
56—John Cory & Sons, Ltd	20	57,806	2,890	19	53,274	2,804	
57—Henderson Line	10	57,493	5,749	10	57,494	5,749	
58—Jones, W. & C. T., S. S. Co., Ltd	14	57,408	4,100	13	53,769	4,137	
59—Ben Line	16	53,196	3,325	16	53,196	3,325	
60—Nautilus Steamship Co., Ltd	13	51,310	3,947	13	51,310	3,947	
61—Tatem Steam Nav. Co., Ltd	11	50,003	4,546	16	75,229	4,701	

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The Value of the Watertight Deck

This Installation Plays an Important Part in Minimizing a Ship's Chances of Disaster After Collision with an Iceberg or Another Vessel

By K. G. Finlay

THAT a watertight deck contributes to the safety of a ship is generally recognized. The purpose of this paper is to indicate to what extent, and under what circumstances, additional safety may be obtained by this method of subdivision. It is necessary, therefore, to consider some of the more serious types of damage met with at sea, and to apply to each a suitable criterion of safety. Here it is proposed to consider first, the long ripping blow, such as may be occasioned by collision with ice, and second, the deep-cutting blow caused by the stem of another vessel. The first type of damage, being longitudinal, is naturally most effectively met by longitudinal subdivision, and it is when contact of this nature occurs with a submerged, or partially submerged object, that the greatest increase of safety resulting from the fitting of a watertight deck is to be looked for. For such cases the most satisfactory criterion of safety appears to be the extent of damage, which under the least favorable circumstances may cause disaster.

Serious Result From Slight Damage

The smallest amount of damage necessary to cause foundering is that just sufficient to cause the floodable length to be exceeded. Thus a ship subdivided only by transverse bulkheads, and designed to float with any two compartments flooded, will sink if she chances to be ripped open under water from the fore side of one bulkhead to the after side of the first bulkhead abaft it. In other words, her damaged length requires merely to exceed, however slightly, one-half of her floodable length.

The additional security against longitudinal damage, obtained by intricate transverse subdivision, is apparently by no means so great as the disparity in the number of floodable compartments would seem at first sight to suggest. Under a watertight deck floodable and damageable length may be considerably increased, the extent of such increase depending mainly on the ratio which the space below the watertight deck bears to the space between it and the bulkhead deck. Under such a deck too, damageable length increases by steps from the point of its minimum value.

In contrasting the lengths of damage permitted by the different systems of subdivision, it should be remembered that any reduction in the spacing of bulkheads, which does not actually add to the number of floodable compartments, must entail a corresponding reduction in the ordinates of the damageable length curves. The placing of a watertight deck at some distance below the waterline having recently been advocated, the writer has examined the effect produced on initial stability when flooding takes place above a watertight deck. It is assumed that flooding occurs about a point one-quarter of the ship's length from the fore perpendicular. This position was selected in preference to amidships, on account not only of the practical difficulty of getting a watertight deck in way of machinery space, but also because it is in connection with damage forward that there is most likelihood of the watertight deck being brought into play. In obtaining these results the method of regarding the internal water as lost buoyancy was adopted, the ship's displacement and position of center of gravity thus remaining unaltered.

It appears that when flooding takes place over a watertight deck, the rise of the center of buoyancy is relatively slight, and is not sufficient to counterbalance the reduction in waterplane moment of inertia, even though the ratio of initial draught to breadth is favorable to stability in the damaged condition.

The result of flooding the same percentages of the lengths of similar vessels having the same draught but greater breadth has been calculated for ships with breadths of 79 feet, 89 feet 6 inches, and 100 feet, respectively.

This investigation demonstrates that although a submerged watertight deck will probably limit the loss of buoyancy resulting from a given length of damage more effectively than one placed above the waterline, danger exists that stability may suffer, the loss of initial stability varying approximately as the length flooded. The risk on this account becomes greater as the ratio of breadth to draught increases.

The chief danger of the ripping blow lies in the fact that its length cannot be predicted; in addition, no assistance from outside, such as may reasonably be looked for by a vessel damaged in collision, is to be expected, consequently the greatest value of the watertight deck will be realized on occasions when the necessity is greatest. Provided that the designer's assumptions regarding the permeability of flooded spaces and the watertightness both of the bulkheads and of the ship's sides up to the bulkhead deck are sound, the effect of being cut into by another vessel can be determined, and transverse bulkheads can be spaced so as to ensure flotation, even though injury be sustained by one of them. In accidents of this nature, the chief source of danger would probably be the resultant loss of dynamical stability. A watertight deck fitted in a ship which has transverse bulkheads of the usual type extending from the double bottom straight up to the bulkhead deck, will be of no service in such an event. It is bound to suffer damage; the water will be free to rise above it, and the result will be the same as if there were no watertight deck.

Spacing of Bulkheads is Important

By spacing bulkheads more closely above the watertight deck than below it, however, it is possible to effect some improvement in stability. As the length of ship increases, the International Convention provides for a gradual reduction in the ratio which the length of compartment bears to the floodable length, and the writer has attempted to ascertain whether the greater margin of stability in the damaged condition thus ensured, could not be obtained by applying the "factor of subdivision" solely to the bulkheads above the watertight deck, and leaving those below that deck at a spacing of not more than one-half of the floodable length.

The greatest loss of freeboard must occur in the event of a bulkhead both above and below the watertight deck being damaged, four compartments being opened thereby. In this case the whole floodable length below the watertight deck and two-thirds of that length above it will be flooded. The greatest loss of metacentric height will be sustained when the only bulkhead damaged is one above the watertight deck.

From a paper read at the spring meeting of the fifty-sixth session of the Institution of Naval Architects.

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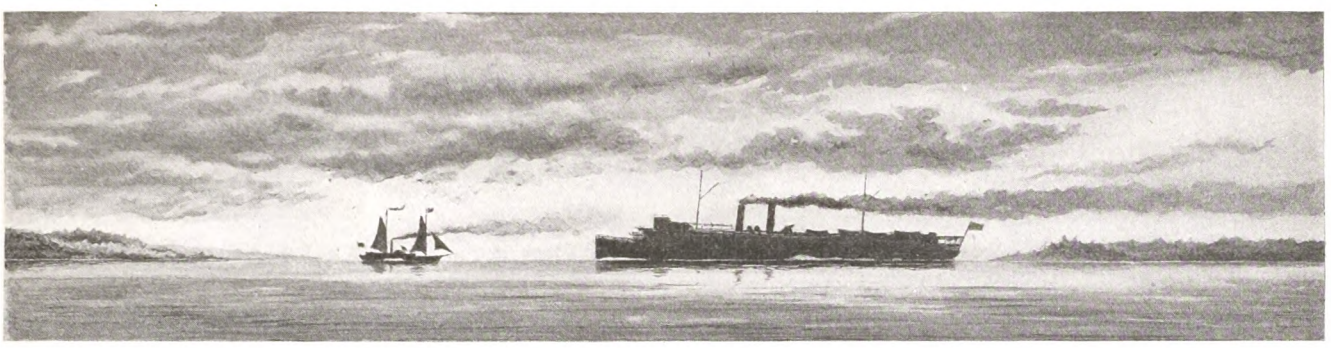


A Contrast—A Modern Lake Sidewheeler and the Pioneer Ontario of 1817

Pioneer Steamships on the Great Lakes

By Frank R. Rosseel

Illustrated by Original, Copyrighted Drawings by the Author

THE first steamers on any of the Great Lakes went into commission on Lake Ontario in 1817, and this year, 1917, the centennial anniversary of the first appearance of these small crude forerunners of the mighty Lake fleets of today seems a specially appropriate time for a short story dealing chiefly with the steamers, conditions and events of the first 15 years of steam navigation on the lakes.

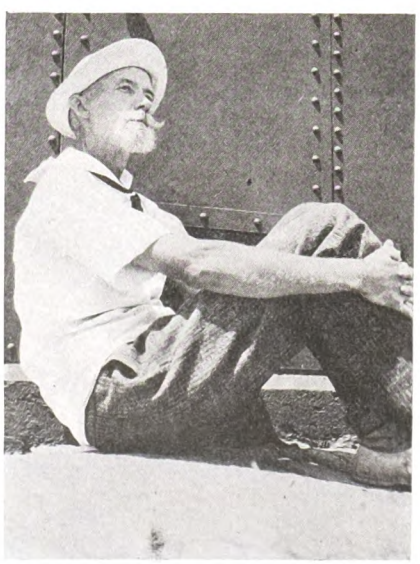
The pioneers of 1817 were FRONTENAC, under the British flag, and ONTARIO, under the American. FRONTENAC was built at Finkle's Point, 18 miles up the Bay of Quinte from Kingston, and ONTARIO at Sackett's Harbor, N. Y. The Canadian ship was first under construction and first in the water. She was launched Sept. 7, 1816, and immediately "proceeded to Kingston to lay up". The *Kingston Gazette* of June 7, 1817, says, "The FRONTENAC left this port on Thursday, the 5th inst., on her first trip to the head of the lake."

Construction was started on ONTARIO in August, 1816, and very early in April, 1817, she started from Sackett's Harbor for the first real try-out of steam propulsion on the long run through the open lake to the Niagara river at its western end. In making this try-out, she was apparently about two months ahead of FRONTENAC, although the latter was launched early in the preceding autumn "with engines aboard".

Rude Lessons from the Wind

On this trip, ONTARIO met with fair weather and a quiet sea until she was getting away from the Genesee river, when a northeast wind set her rolling, and her people learned for the first time that paddle-wheel shafts must be fastened at the outer bearings. ONTARIO is said to have been the first steamer operated in a heavy enough sea to demonstrate this point. At any rate, her shafts lifted and tore things to pieces, and she put back; thereafter wheel shafts were made fast in their bearings. ONTARIO was 110 feet long on deck and 24 feet beam, with 8½ feet depth of hold and 237 tons burden; she had a low pressure beam engine with a 34-inch cylinder, 4-foot stroke. She had two masts and full fore-and-aft rig. FRONTENAC was 170 feet long on deck and 32 feet beam with a registered tonnage about 700. The circumference of her paddle wheels was about 40 feet. She had three masts with fore-and-aft sails throughout.

Ogdensburg, N. Y., and Prescott, Ontario, 70 miles down the St. Lawrence and a few miles above the first rapids in that river, were the natural eastern terminals for the first Lake Ontario steamboats, there being then no canals on the river. ONTARIO, on account of her light draft, found no difficulty in navigating the treacherous and uncharted Thousand Islands, and ran regularly between Lewiston on the Niagara river and Ogdensburg; but FRONTENAC, drawing 10 feet, picked up a shoal on her first trip to Prescott and thereafter kept out of the river, making Kingston her eastern terminal point. Her run was from Kingston to York (now Toronto) and across the Lake to Niagara, and her schedule called for three round trips per month.



THE AUTHOR
From a photograph taken at Cross Over Island Light, St. Lawrence River

No Speed to Brag About

The old Lake Captain to whose writings and pictures I refer at length later on, said ONTARIO's speed was about seven miles per hour. This was, no doubt, her best. Another historian says she seldom made over five miles per hour. I have found no record of FRONTENAC's speed, but I doubt if she made much better time than ONTARIO. FRONTENAC was burned in 1827 in the Niagara river, and ONTARIO was hauled out and broken up at Oswego in 1832.

The opening of the service of these pioneer steamers was a greater event in its day along the shores of Lake Ontario and the St. Lawrence than the opening of regular service with aeroplanes would be today or would have been five years ago. The era of startling inventions was just beginning. Since the beginnings of civilization the means of travel by land or by water had changed but little, and along the northern frontier a hundred years ago land journeys were made on foot, on horseback, or behind plodding ox teams, over rough roads, and those who went by water found passage in canoes, Durham boats, arks, or small schooners. The railroad was still far in the future. I can well understand the wonder and awe with which the inhabitants gathered in each little lake port to see "the steamboat", greeting her arrival with firing of cannon and ringing of bells.

Today a thousand papers and periodicals present to the public reliable reproductions of photographs of new ships, on the stocks, being launched,

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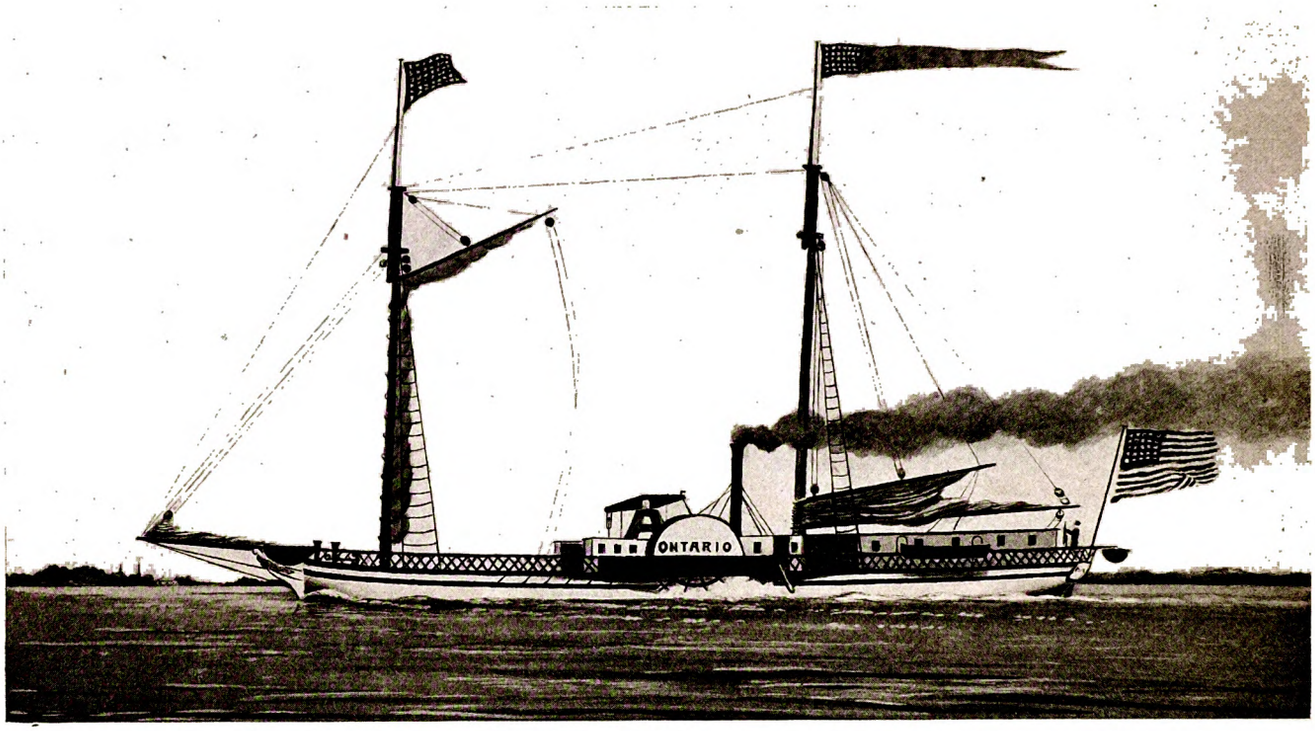
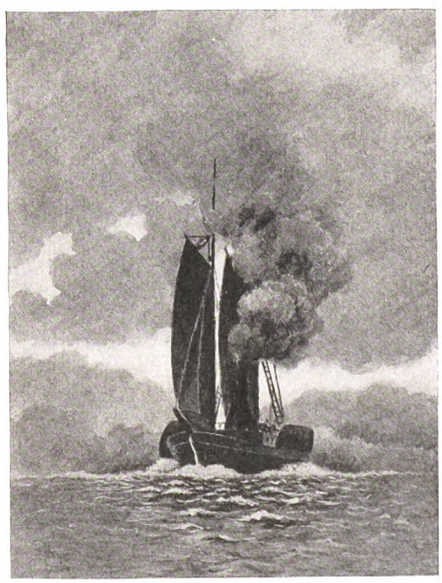


and completed and ready for business. A photograph of almost any ship of today can be obtained. These conditions are in marked contrast with those existing in the early part of the last century. Photography was then unknown; illustrated publications were few; and the great lack of reliable pictures of early steamers is indicated by the impossibly crude drawings often reproduced with articles bearing on navigation a hundred years ago. My reading and investigation on the subject lead me to believe that the only known, reliable, original pictures of FRONTENAC and ONTARIO are those of which I present careful reproductions with this article. These originals are the work of Capt. James Van Cleve, a man exceptionally well qualified, for he was a sailor, with the gift of picture making. He was clever with pencil and brushes and knew personally, not only ships of his day generally from all points of view, but the *very* ships of which he left pictures and water colors from his own sketches dated from 1826 on to the time of the use of the camera.

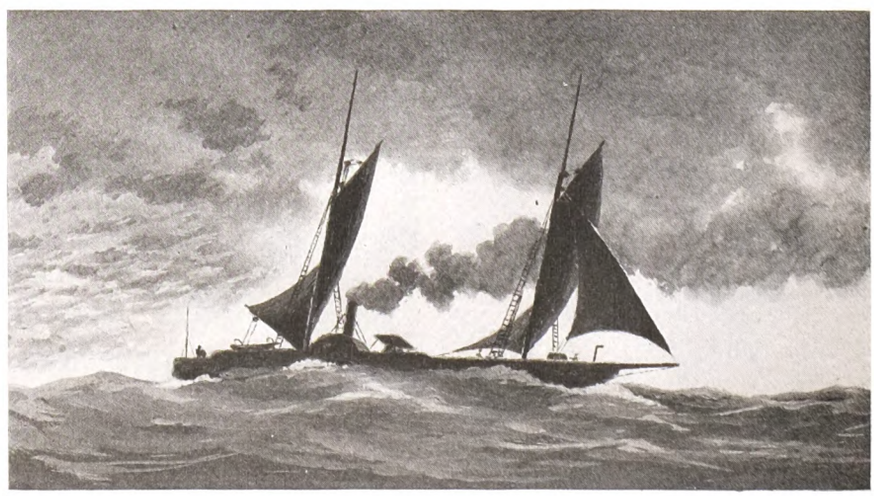
A Sailor and an Artist

He began a long career as a Great Lakes sailor in 1826 as a clerk on the pioneer steamer ONTARIO. His sketches of ONTARIO and FRONTENAC were made that year. He became a well-known commander of both sail and steam vessels on the Lakes. In 1843, when he commanded ST. LAWRENCE, a side-wheeler, plying between Lewiston and Ogdensburg. My father was his clerk; and my knowledge of him and his artistic proclivities dates back to the late seventies, and my father's receiv-



Faithful Reproductions

THE illustrations accompanying this article are the result of considerable patient historical research, and the author, Frank R. Rosseel, vouches for the accuracy of the reproductions. Several of the drawings are faithful "translations" by Mr. Rosseel of sketches made by Capt. James Van Cleve, a well-known commander of early steam and sail vessels on the Great Lakes. Capt. Van Cleve was an accurate draftsman, as well as something of an artist, and this forms the basis of Mr. Rosseel's assertion that these illustrations include the only reliable, original pictures of Frontenac and Ontario. The illustration at the top of this page shows Ontario the first American steamer on the Great Lakes, as she appeared on her maiden voyage in 1817. Opposite, on page 137, is a sketch of Frontenac, the



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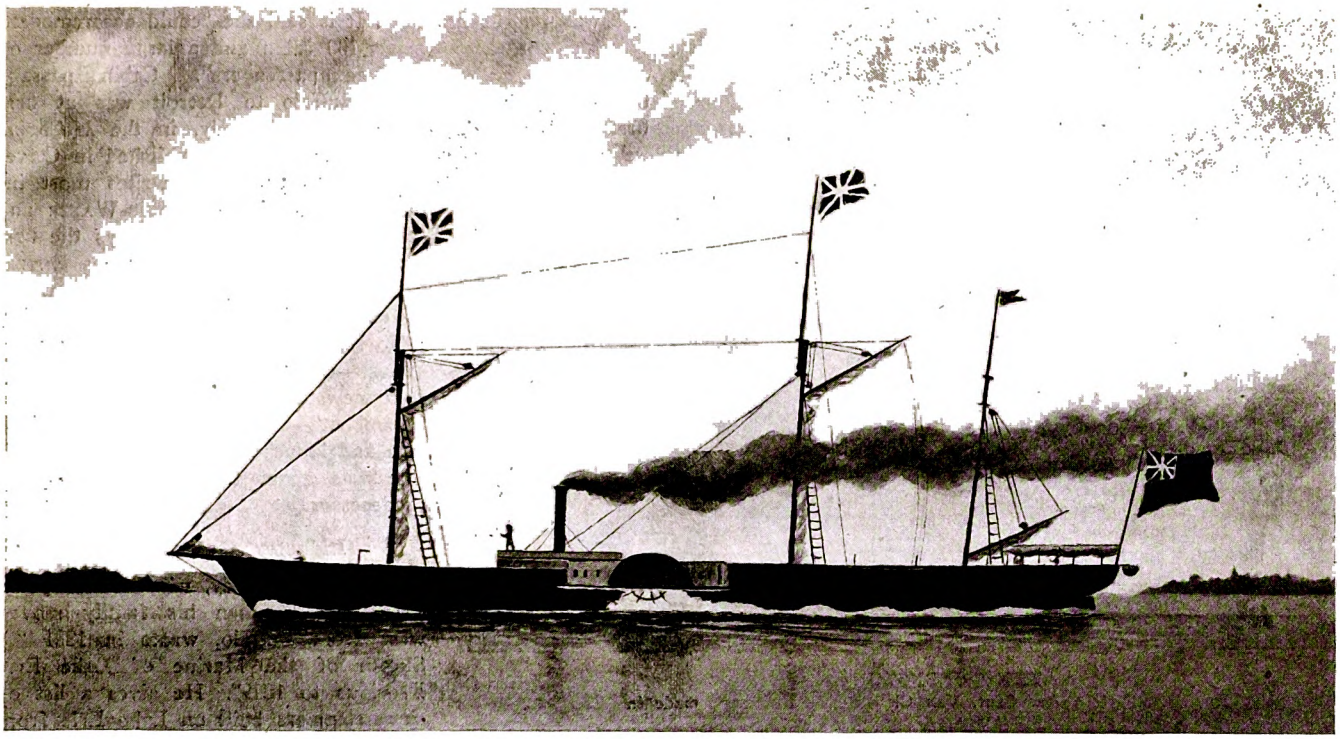
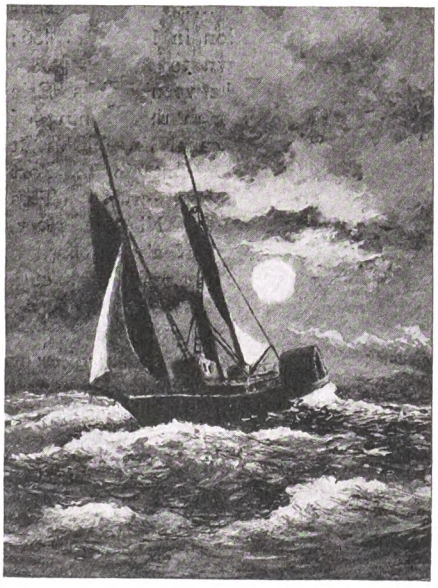
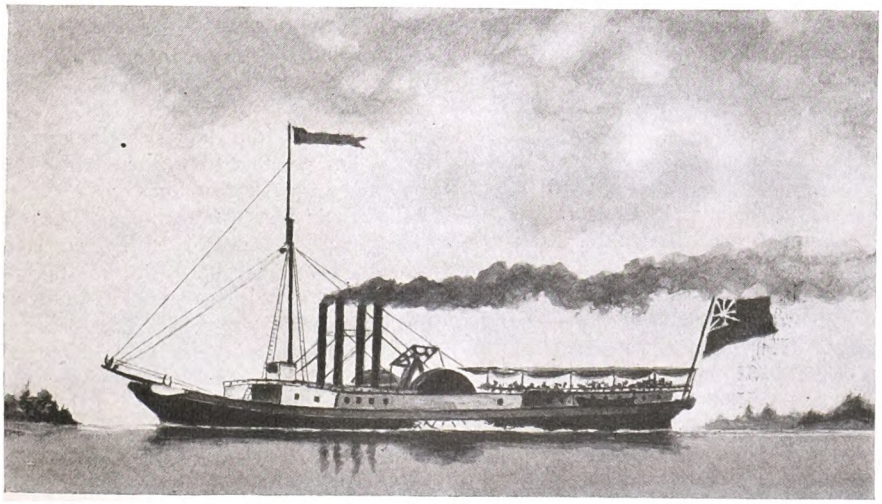


of Early Lake Steamers

Canadian contemporary of Ontario. Both of the original sketches by Capt. Van Cleve were made in 1826. *The small cuts in the middle of pages* 136 *and* 137 *show Mr. Rosseel's conceptions of Ontario and another early Lake packet, in different conditions of wind and weather. Ontario, coming head on after sunset, is shown on page* 136. *At the bottom of the same page is another view of old Ontario again at twilight. Her outline against the bright sky is higher amidships than at the bow and stern because of her listed position. The cut at the bottom of page* 137 *shows William-the-Fourth, first monarch of the Lakes, with four smokestacks. She was active in* 1832 *and was considered a greyhound in her day. This drawing is after a sketch of Capt. Van Cleve's made in* 1835.





ing from him a spirited water color of the steamer on which they had been shipmates.

There was a brisk trade, carried on in schooners on Lake Ontario, and in scows and arks down the Rapids to Montreal previous to the war of 1812-14. The embargo preceding the war checked this commercial activity and the war itself killed it for the time. Many of the schooners were transformed into vessels of war in the opposing fleets. As soon as peace was restored, plans for the first steamboats on the Lakes began to take form. Steamboats had been in operation on the Hudson river about New York for several years previous to the appearance of the first steamers on the Lakes, and as early as 1809 a crude side-wheeler, 70 feet in length, called ACCOMMODATION, started regular service on the River St. Lawrence between Montreal and Quebec.

Early Navigation Dangerous

The operation of steamers on the Great Lakes, however, presented some difficult problems not met either on the Hudson or the St. Lawrence about Montreal and Quebec, among them greater seas to be encountered and fewer opportunities for shelter from storm. In both of the other localities mentioned the steamers plied between cities of considerable size, surrounded by country long settled, with many towns and a great cultivated area, where the activities of civilization furnished a steady volume of passengers and freight, and where harbors were easy of entrance and afforded safe shelter.

So far as general commerce was concerned, the Lakes up to about 1830

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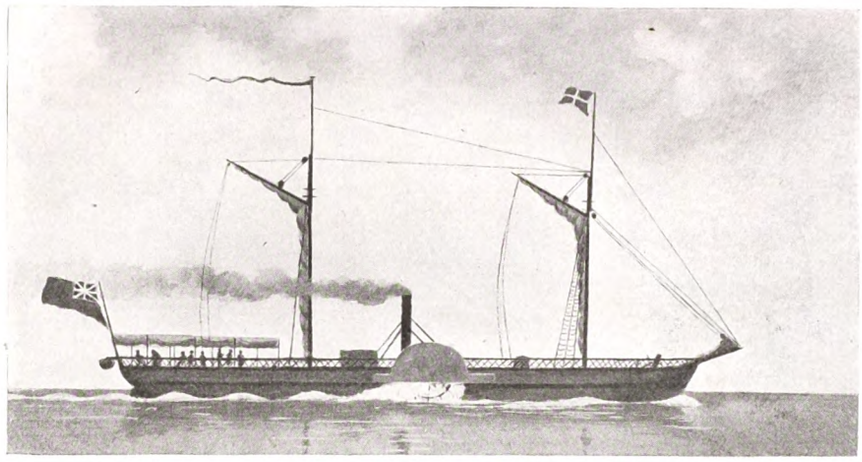
meant Lakes Erie and Ontario and most of the territory surrounding even these two eastern lakes was still a wilderness for 10 years after the first steamers went into operation. Practically all of the lake ports were small villages near the mouths of rivers, entrance to which, on account of sand bars formed by river currents and lake winds, was uncertain under the best of conditions, and impossible in stormy weather. This often meant riding out a gale at anchor off some port, to reach which these low-powered, clumsy side-wheelers had battled fiercely for hours. There were no charts, no dredged channels, no breakwaters, no lighthouses, no elaborate system of buoys and ranges and other aids to navigation, no fog sirens—in fact, no steam whistles for many years—and no weather bureau warnings.



THE QUEENSTON OF 1824
By Mr. Rosseel, after Capt. Van Cleve's original sketch made in 1827.

When Detroit was a Wilderness

The opening of the Erie Canal in 1825 diverted to the Lake route a heavy tide of settlers bound for the west and gave a great impetus to the ship building industry on Lake Erie. About this time the United States government began making small appropriations for harbor improvements at the more important lake towns. Pretty much all the business was westbound, and Detroit was the westernmost port of call. Chicago was only a hamlet of a dozen houses in 1831, and up to 1832 practically the only commerce west of Detroit was that in connection with the fur trade and the transportation of supplies to western military posts, all of which was handled by schooners.

Although the population of Ohio had grown to about half a million in 1820, the populous counties did not lie along the Lake. As late as 1830 Detroit contained but little over 2,200 inhabitants. In the late twenties a few steamers made excursion trips into Lake Michigan—something like an annual pleasure cruise into the wilds. It was not until 1836 that the first grain shipment came to Buffalo from the West.

The populations of the three principal Lake ports in the first half of the nineteenth century were as follows:

	1810.	1820.	1830.
Buffalo	1,508	2,095	8,653
Cleveland	57	350	1,075
Detroit	.....	1,442	2,222

Toronto's population in 1813 was 456; in 1834 it had grown to 10,000.

Vessel passages between Lakes Erie and Ontario began with the opening of the first Welland canal in 1829. It extended from Lake Ontario to Port Robinson on Chippewa creek. This creek empties into the Niagara river, about a mile and a half above Niagara Falls, at a point where the river's current is very swift. Teams of 12 to 16 oxen helped schooners and steamers up along the river shore for a mile or so toward Lake Erie and again past the rapids at the head of the river.

The village of Black Rock, long ago taken into the city of Buffalo, lay on the river below the rapids. It had a deep water harbor, and in the early days there was bitter rivalry between Black Rock and Buffalo. Its shipping, however, had to be helped up to the lake by "bull teams". There were 40 locks in this first Welland canal. They were built of wood and were 110 feet long, 22 feet wide, and 8 feet deep. In 1833 the canal was opened through to Lake Erie.

The first steamboat built or operated west of Niagara Falls was WALK-IN-THE-WATER, built at Black Rock in 1818. She ran between Black Rock and Detroit, stopping at all way ports, until beached in a gale near Buffalo in 1821, thus ending a short, but very successful career. Her length is given at 135 feet, beam 32 feet, and depth 8 feet 6 inches. Her tonnage is variously stated at from 300 to 350 tons; and I judge her best speed under favorable conditions was about eight miles an hour. It is said she "could accommodate about 100 cabin and a large number of steerage passengers". Cabin passage from Buffalo to Detroit was at first $18. J. H. Kennedy, in the *Magazine of Western History,* published in Cleveland, September, 1885, writes most interestingly of WALK-IN-THE-WATER and other early steamers. He says the first steamboat built in Cleveland was ENTERPRISE, in 1824, of about 220 tons, which an engine of from 60 to 70-horsepower.

To replace the wrecked WALK-IN-THE-WATER—usually referred to in the Buffalo newspapers of her day as "the Steamboat"—SUPERIOR was built in Buffalo and launched in the spring of 1822. She was about the same size as her predecessor.

Industry Grew Rapidly

Francis A. Dewey, who was 18 years old in 1829, when his family moved west from Buffalo, wrote in 1881 "A Sketch of the Marine of Lake Erie Previous to 1829". He gives a list of eight steamers built on Lake Erie from 1822 to 1828, as follows:

Steamer—Where built.	Year launched.	Tonnage.
Superior, Buffalo	1822	400
Chippewa, Buffalo	1823	60
Niagara, Black Rock	1826*	250
Henry Clay, Black Rock	1826*	300
Enterprise, Cleveland	1826*	300
Pioneer, Buffalo	1826*	100
William Penn, Erie	1826*	300
William Peacock, Barcelona	1828	200

*Possibly 1827.

He says all had steering wheels on the stern, none had cabins above deck, and that they usually carried from 20 to 30 cords of wood for fuel. He also says the first steamer with cabins on deck (meaning on Lake Erie) was MICHIGAN, of 475 tons, launched at Detroit in 1833. Beers' "History of the Great Lakes" mentions some or all of the eight steamers, but gives them different tonnage. This work also refers to MICHIGAN "launched April 27, 1833", and says she was the largest steamer then on the Lakes and the second steamer built at Detroit; length 156 feet on deck, beam 53 feet (evidently meaning over her guards), depth of hold 11 feet. The writer also refers to her cabin on the main deck. Beers' History also says the first *upper* cabin was on GREAT WESTERN in 1839, and that she was the largest steamer on the Lakes to that time; she was 781 tons and was 180 feet long.

In his history of the Great Lakes, Hon. Crocket McElroy, a retired lake captain, says, "In the 10 years following 1822 16 steamboats were built on the Lakes and then in 1833 16 were built in one year, and in 1834 12 more."

A period of great activity on the Lakes was setting in about 1835, but I have little space in which to refer to it. J. H. Kennedy, in an article before referred to, says, in 1835 Cleve-

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land's population was 5,080; steamboat fare, Buffalo to Detroit, was $8; boats were crowded; and from March 15 to Nov. 28, 1836, there were 1,901 vessel arrivals at the port of Cleveland. Beers' History says, "In May, 1836, 90 steamboats arrived in Detroit, all with passengers for Michigan and the West."

Meantime on Lake Ontario, following ONTARIO and FRONTENAC of 1817, came in 1818 the steamer SOPHIA of 75 tons, built at Sackett's Harbor and operated between that port and Kingston, Ontario. MARTHA OGDEN, also built at Sackett's Harbor, came out in 1825. She was of 150 tons. The Canadians launched QUEENSTON, of 400 tons, at the town of the same name, on the Niagara river, in 1824. She ran between Queenston and Prescott. ALCIOPE, of 450 tons, was built at Niagara, Ontario, in 1828.

In the early thirties there appeared steamers with two smoke stacks placed abreast and wide apart, and two walking beams, working separate paddle wheels, a most unhandy arrangement for the engine room in heavy weather, but mighty convenient in working about a harbor in close quarters. Capt. Van Cleve presents pictures of two steamers of this type—UNITED STATES, of 450 tons, launched at Ogdensburg in 1831, and GREAT BRITAIN, of 500 tons, launched at Prescott about the same time. Cabins on main decks, with awnings spread over upper deck aft; bluff bows, with great cutwaters reaching up and out in a broad double curve, and profusely ornamented with gilded scroll work, were characteristic of these vessels. MICHIGAN, launched at Detroit in 1833, seems to have been of much the same type.

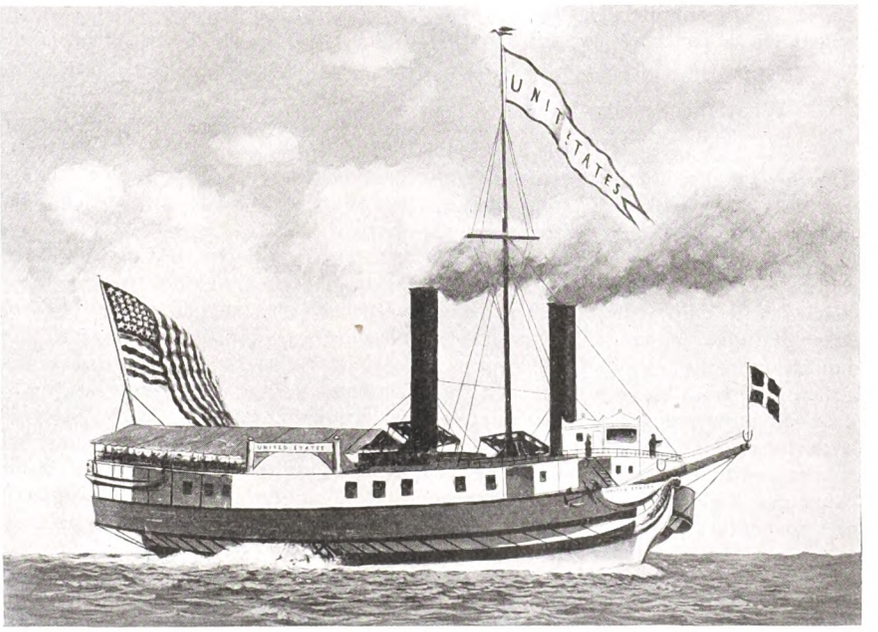
James C. Mills in "Our Inland Seas" says, UNITED STATES was the most favorably known of all the popular lake steamers of her day; he gives her cost as over $50,000, and her dimensions as follows: Length, 142 feet; beam, 26 feet; overguards, 55 feet; depth of hold, 10 feet.

I must refer to one more steamer, of which Captain Van Cleve left a picture, WILLIAM THE FOURTH, of 450 tons, built at Gananoque, Ontario, 18 miles below Kingston on the St. Lawrence, in 1832. She had four smoke stacks, two abreast.

During the period to which I have aimed to devote most of this article, that of the beginnings of steam navigation on the Lakes, 1817-1832, builders gradually worked away from the idea that steamers were sailing vessels plus steam power. I think every steamer for at least the first 10 years carried canvas of sufficient area to make it possible to navigate her under sail power alone. Full-rigged masts; round bluff bows; long, overhanging curved stems; heavy bowsprits and square sterns, upon which the steering wheel was placed, all showed evolution from the sailing vessel. Captain Van Cleve's pictures of UNITED STATES, GREAT BRITAIN, and WILLIAM THE FOURTH, 1830-32, show steamers carrying but one mast, though ST. LAWRENCE, 180 feet long and of 450 tons, launched at Oswego in 1839, was full schooner rigged. It is worthy of note that for 15 years or more after the construction of the pioneer FRONTENAC no other steamer of anything like as great dimensions appeared on the Lakes. Even MICHIGAN of 1833 was but 156 feet long as against the 170 feet of FRONTENAC.

Referring to the handling of ONTARIO, Captain Van Cleve said there was no engine room gong for signals from captain to engineer, and that orders were repeated by a man who stood outside the engine room door. The engineer's name was Ramsey, and the captain's oft repeated orders "Give her a kick ahead, Mr. Ramsey"; "Give her a kick astern, Mr. Ramsey", came to be by-words aboard. On one occasion, when there was the devil of a time bringing her alongside the wharf, some wag offered the suggestion "Give her a kick sideways, Mr. Ramsey."

(The Van Cleve pictures accompanying the article on pioneer steamships on the Great Lakes, by Frank R. Rosseel, in this issue of *The Marine Review*, were copied by permission from a book of reminiscences prepared for and presented to the Buffalo Historical Society, Buffalo, N. Y., by Capt. James Van Cleve in 1877.)



THE UNITED STATES OF 1831

She is said to have been the most favorably known of all the popular steamers of her day. By Mr. Rosseel, after Capt. Van Cleve's original sketch dated 1834.

Book Review

Johnson's Steam Vessels of the Atlantic Coast; leather, 262 pages; 4½ x 8 inches; published by Eads Johnson Publishing Co., and furnished by *The Marine Review*, for $5 net.

This volume is a directory of steam vessels owned on the Atlantic coast. The fleets are arranged in alphabetical order according to the names of owners, and the particulars given of each vessel include the dimensions of the hull, date built, where built, engine and boiler data, gross and net tonnage, etc. In addition to the list of owners, the index contains a list of vessel names. This arrangement enables one to readily locate any information sought, whether he is familiar only with the name of the vessel or name of the fleet owner. The rear pages of the book are devoted to miscellaneous useful data, such as a table of distances in statute miles from New York to various ports of the world, a table showing a quick method of approximating the weights of shafts, decimal equivalents of fractions of an inch, circumferences and areas of circles, weights of square and round bars of wrought iron in pounds per lineal foot, weight and strength of chain, hemp and wire rope, etc.

Michael Geoghegan has resigned his position as manager of the contract department of Davies, Turner & Co., New York, and B. F. Hernandex as manager of the steamship department of that company, to take a more active part in the affairs of the Freighters Transportation Co., 42 Broadway, New York, of which Mr. Geoghegan is treasurer and Mr. Hernandez secretary. The change became effective Feb. 1.

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What the Government is Doing

Rulings on Marine Matters — Improvements to Waterways

Hints to Navigators

Poor Laws Hamper Steamboat Inspection

WHATEVER criticism may be justly directed toward the United States steamboat-inspection service must be based fundamentally upon the ineffectiveness of the laws, according to a report just submitted to the committee of the Chamber of Commerce of the United States, on the department of commerce. The laws should be revised. If so, at the outset they should bestow a legal title upon the service, which it is declared it has not now, and one which will indicate the nature and scope of the service.

For a considerable period, before the EASTLAND disaster in fact, the national chamber's committee, has been giving attention to the steamboat-inspection service. N. Sumner Myrick, Boston, a lawyer and expert, was secured to make a special study of the subject. His report is submitted after personal investigation covering several months and visits to the principal ports.

What the Service Needs

Mr. Myrick's report recommends that the supervising inspector general and the supervising inspectors should be included in the classified service. There should be no possibility of political appointees. It is said the salaries now paid will not attract the class of men whom it is desirable should enter the service in the future. It being physically impossible for the force as now constituted adequately to perform its duties there should be an increase in the number of assistant inspectors and clerks. The supervising inspectors should be granted larger powers, given greater responsibilities and authorized to travel more extensively throughout their respective districts than they now do. These inspectors meet annually at Washington as a board to establish regulations designed to give effect to the laws. This board should be superseded by a smaller board, composed of the supervising inspector general and technical employes of the government, including an assistant solicitor of the department of justice who is qualified to answer question on maritime law. There should be, the special investigator's report says, a standardization of examinations for licensed officers. Today it is easier to pass an examination in one district than in another. The report declares that rewards given to informers for reporting infractions of the law, or for bringing suits because of such infractions, ought not to remain in force. The provision that the Secretary of commerce shall make regulations to secure the execution of the law, that power by a previous section having been conferred upon the board of supervising inspectors, should be repealed. Authority to make investigation of marine casualties should be vested in some board connected with the inspection service.

A properly constituted board, according to the report, composed of a maritime lawyer, an executive officer and an engineer officer should be created for investigating alleged misconduct or negligence of licensed officers. Those appearing before this board could, in cases of prescribed magnitude, appeal from the board's decision to the department of commerce.

There is now no law in the United States to prevent the overloading of vessels. The report to the national chamber committee advocates some law based upon the Plimsol law of England. The convention of the International Conference for Safety at Sea, held at London, which has been ratified by the senate of the United States, ought to be made applicable by law to the ocean commerce of this country so far as it does not now apply.

The establishment of a board is urged for the approval of plans and method of construction of vessels built in the United States. The present law governing life boat and life raft equipment of steam vessels is unsatisfactory to vessels owners, and does not, the report says, adequately meet the views of many who have considered it from an unselfish, detached point of view.

There is no law that requires fire-resisting construction in any class of vessel; none that specially requires the modern appliances found effective in extinguishing fire in its early stages in manufacturing establishments, although it is said a recently enacted regulation of the board of supervisors partially meets this criticism.

"The British Board of Trade is the very bulwark of British commerce," Mr. Myrick's report to the national chamber committee concludes. "No other maritime nation possesses an agency for the promotion of commerce as carried on in ships comparable to it. With the awakening sense of the American people to the necessity of an adequate merchant fleet for the promotion of our overseas commerce, it may well be that the time has arrived when plans should be made to constitute in the United States a controlling body similar to the British Board of Trade and having the same oversight in all matters relating to ships."

Barge Canal Lighthouses

A complete system of lighthouses for navigation on the New York state barge canal, the last parts of which are now nearing completion, is planned by the state. This is described in a statement by Frank M. Williams, state engineer and surveyor, in a recent issue of *The Barge Canal Bulletin*.

Since the barge canal for a large part of its length lies in natural waterways, it has become necessary to mark the channel in these rivers and lakes so that it can be easily located both day and night. For this purpose various aids to navigation, such as buoys, beacons and lighthouses, are employed. In the rivers it has been found sufficient to place small buoys at the ends of tangents and on curves, to mark the limits of the navigable channel. The bodies of water which have to be provided with lighthouses by the state are Oneida, Onondaga, Cayuga and Seneca lakes. On Cayuga and Seneca lakes there are several existing lighthouses which have been in

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use for the traffic upon these lakes and which can be adapted to future needs with but few changes.

The lighting of Oneida lake presents an interesting problem, since it approaches very nearly to marine conditions. The lake is about 20 miles long and five miles wide. It has a maximum depth of 55 feet, but there are numerous shoals which tend to make navigation difficult. Moreover, the surrounding shores are low and offer but few natural landmarks for aids to navigation. There are two small harbors on the north shore of the lake, Cleveland and Constantia, the approaches to which require marking, as it is contemplated that they will be of service as harbors of refuge in addition to their use for local freight traffic. While not of frequent occurrence, the lake is somewhat subject to sudden and severe storms, which render necessary a positive marking of the sailing courses and of the shoals. The main sailing course will be principally marked by three concrete lighthouses, about 85 feet in height. The first will be at Sylvan beach at the easterly end of the lake and will display an occulting white light of 1,500 candlepower. The second lighthouse is to be located on Frenchman's island. This also will display an occulting white light of 1,500 candlepower. It happens that this island is so situated near the western end of the lake that one straight sailing course nearly 14 miles long and which avoids shoals can be laid toward its lighthouse from the Sylvan beach entrance at the eastern end of the lake. The third lighthouse will form the rear range for the outlet channel at Brewerton and will carry a fixed red light of 1,000 candlepower. The front range at Brewerton is to be a similar light placed on the highway bridge at an elevation of 30 feet above the water level.

The lighting of Onondaga lake, while not so important as that of Oneida lake, is interesting because of the fact that it forms the approach to the Syracuse terminal.

As the entrances to the barge canal at the Hudson river, Lake Champlain, Lake Ontario and the Niagara river are under the jurisdiction of the United States, the marking of the channels at these points is taken care of by the federal government. Such lights as are in existence are described in the federal buoy list and shown on the published charts.

The contract for the lighthouses, buoys and beacons on Oneida and Onondaga lakes has been let and it is expected that these installations will be in operation at the opening of navigation in 1917. The lighthouses on Cayuga and Seneca lakes have been in operation for the past season of navigation, and it is expected that a contract will be prepared at an early date to provide for the buoys and such other lights as will be required for this course.

Many New American Aids to Navigation

A NET increase of 412 in the total number of aids to navigation maintained by the United States, during the fiscal year ended June 30, 1916, is shown by the commissioner of lighthouses in his report to the secretary of commerce.

Several new works under special appropriations were completed during the year, as follows: Point Judith breakwater lights, R. I.; Fort McHenry channel lights, Md.; Norfolk harbor lights, Va.; Atchafalaya entrance lights, La.; and Ashland breakwater light and fog signal, Wis. Other construction work was in progress at the close of the fiscal year, the most important items being the new lighthouses for Cape St. Elias, Alaska, and Navassa island, West Indies. While far apart in location, these stations present somewhat similar problems by reason of their unusual remoteness and inaccessibility, under widely different conditions. Good progress has been made on both. The light at Cape St. Elias went into commission in September, 1916, and it is expected that the light at Navassa will be ready in the spring of 1917.

Systematic Methods of Improvement

Improvements in aids to navigation have been made during the year as follows: Flashing or occulating lights were installed in place of fixed lights at 49 stations; incandescent oil-vapor lights were substituted for oil-wick lamps at 19 stations; acetylene or oil-gas lights were substituted for oil lights at 44 stations, including two light vessels. New lighthouses, with fog signals, were established at Rondout North dike, Hudson river, N. Y., and Point au Fer Reef, Atchafalaya entrance, La. It is believed that systematic methods of improvement and the use of modern apparatus in increasing the number and brilliancy of aids have been of value to the safety of commerce.

The United States lighthouse service maintains aids to navigation on all coasts under the jurisdiction of the United States, except the Philippine islands and Panama, and also on the principal interior rivers. This service is charged with the maintenance of aids to navigation along 47,192 statute miles of coast line and river channel. On June 30, 1916, there were 5,791 persons employed in the service, including 123 in the technical force, 147 in the clerical force, and 5,521 employes connected with depots, lighthouses, and vessels. The total number of aids at the end of the year was 14,947. Of these 5,323 are lights of all classes and 584 are fog signals. The total number of aids in Alaska, comprising lights, fog signals, buoys, and daymarks, in commission at the close of the fiscal year was 388, including 147 lights.

Devices for automatically replacing burnt-out incandescent electric lamps have been developed and installed. Experiments were made to investigate the reliability of obtaining distances at sea by observing the elapsed time between radio and sound signals dispatched simultaneously. Semaphore signals were installed for the first time in the lighthouse service to assist in regulating vessel traffic in congested portions of the Detroit river, Mich.

In accordance with the established custom of the service, effort has been continued to consult the needs of maritime interests and to co-operate effectively with other branches of the government in related work. Deck officers of lighthouse tenders assisted in examinations under the steamboat-inspection service of applicants for certificates as lifeboat men required by the seaman's act, and advice was given as requested in connection and repair of vessels belonging to other maritime services of the department of commerce.

New Tenders Commissioned

During the year 45 tenders and 66 light vessels were in commission. The new tender ROSE was completed and immediately placed on duty for service in the bays and sounds of Washington and Oregon. Two new light vessels were nearly completed at the close of the year—No. 101, off Cape Charles, entrance to Chesapeake bay, Va., and No. 102, at Southwest pass, entrance to Mississippi river, La. The following new vessels are also under construction: The first-class tender CEDAR, for Alaska; the shallow-draft tender PALMETTO, for service in the inside waters of the south Atlantic coast; and light vessel No. 99, for relief duty on the Great Lakes. Services in saving life and property were rendered and acts of heroism performed by employes of the lighthouse service on 161 occasions. The commendable

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recommendation is renewed for legislation authorizing the retirement of employes of the lighthouse service on account of age or disability incident to their work, which is the practice of the lighthouse services of many other countries. A bill providing for the retirement of aged persons in the lighthouse service was passed unanimously by the senate in April, 1916, but has not yet been acted upon by the house of representatives. Recommendation is also made for an increase of salary for lighthouse inspectors, who are considered underpaid in view of the important responsibility borne by them.

The appropriations for the maintenance of the lighthouse service for the fiscal year 1916 are $5,239,030, being $75,000 in excess of those for the preceding fiscal year. In addition, there are special appropriations aggregating $999,000, for various new works, including also two appropriations amounting to $325,000, for repairs necessitated by hurricane damage on the Gulf of Mexico.

Transporting Dangerous Articles

The secretary of commerce, in a recent circular, issued by the steamboat inspection service, entitled "Caution and Admonition to Those Concerned in the Transportation of Dangerous or Inflammable Articles", addressed to masters, owners, and agents of vessels engaged in the transportation of general cargo, and also vessels carrying passengers and cargo, and others concerned, calls attention to certain dangerous practices in the transportation of dangerous or inflammable articles, from which accidents have resulted, and admonishes and cautions all concerned regarding the great care which should be exercised by shippers and carriers in packing, shipping, and stowing inflammable or combustible materials, whether in restricted or exempted lists or not.

The department circular states that recent developments while investigating casualties occasioned by fire on vessels at sea, and particularly on those vessels that carry both cargo and passengers, lead the department to issue this letter of admonition and caution to all concerned regarding the great care which should be exercised by shipper and carriers in packing, shipping, and stowing inflammable or combustible materials, whether in restricted or exempted lists or not, as it has been most clearly demonstrated that fire, the most dreaded of all the hazards, can be averted and prevented by the exercise of possible precautions.

It has been found that roofing paper, in each roll of which was a can or canister of paint with benzene as an ingredient, was carried in large quantities in the lower hold of a steamer which was recently destroyed by fire, entailing a money loss of nearly $1,000,000, but fortunately resulting in no loss of life.

Excelsior, the inflammable properties and dangerous character of which are well known, is carried under various conditions in large quantities in the lower holds of steamers, in contact or in close proximity to other cargo easy of ignition, thereby setting up a condition which at once invites danger and possible disaster.

Acids which should be restricted to deck stowage have been found in both between decks and lower hold, the serious consequences of which should be realized by all who accept acids for transportation.

These are but few of many examples of dangerous practices which should be promptly and permanently corrected with a firm determination to carry out the necessary principle of "safety first" at sea. This cautionary letter is sent with the sincere hope that the lessons taught by experience may not be lost upon those concerned, whose earnest purpose is known to be the promotion of safety. This, it is believed, can be greatly enhanced without inconveniencing or retarding commerce in any manner.

Court Reverses Ruling

THE United States steamboat inspection service, in a letter, Feb. 24, 1917, addressed to inspectors of the service, steamboat companies, and others concerned, published a court decision reversing an opinion of the attorney general, dated July 26, 1916, relative to whether the words "this act" in the phrase "the construction of which shall be begun after the passage of this act," appearing in section 6 of the seamen's act of March 4, 1915, refer to that act or to the act of March 3, 1897. The attorney general's ruling was explained fully in the March issue of *The Marine Review*.

Applies to Vessels Constructed Since March 4, 1915

The court has decided that section 6 of the act approved March 4, 1915, known as the seamen's act, applies only to those vessels which have been constructed since the approval of the said act of March 4, 1915. The decision of the court will be appealed. The circular letter says in regard to this decision:

Referring to circular letter from this bureau, dated Jan. 5, 1917, publishing the conclusion of the opinion of the attorney general, dated July 26, 1916, relative to whether the words "this act" in the phrase "the construction of which shall be begun after the passage of this act," appearing in section 6 of the seamen's act of March 4, 1915, refer to that act or to the act of March 3, 1897, you are informed that the court has decided that section 6 of the act approved March 4, 1915, known as the seamen's act, applies only to those vessels which have been constructed since the approval of the said act of March 4, 1915.

The decision of the court will be appealed, and pending the appeal and the determination thereon inspectors are directed to enforce the provisions of section 6 of the act above referred to only upon those vessels which have been constructed since March 4, 1915.

House Flags and Funnel Marks Registered

The United States bureau of navigation announces the registration of the following described house flags and funnel marks:

Standard Oil Co., 26 Broadway, New York: House flag—a rectangular flag divided into two triangular fields by a line extending from the upper corner of the hoist to the corner diagonally opposite; the upper triangle blue and the lower triangle red; superimposed on the flag at its center the letter S on a white O; the middle part of that portion of the letter O which is not covered by the letter S cut away to allow the fields to show through; funnel marks—the funnel is black with a white band equal in width to the diameter of the funnel, having its top one diameter from the top of the funnel.

Ore Steamship Corporation, 111 Broadway, New York: House flag—a rectangular blue flag with a horizontal white stripe at top and bottom; in the center of the blue field the letter O in white; funnel marks—a slate-colored funnel with the house flag superimposed thereon at a distance from the top equal to the width of the flag.

A. F. Thane & Co., San Francisco: House flag—a white, swallow-tailed burgee with red stripe of uniform width around the entire outer margin; this stripe extended from the apex of the swallow-tail in an unbroken line to each of the sides and from these points to the center of the

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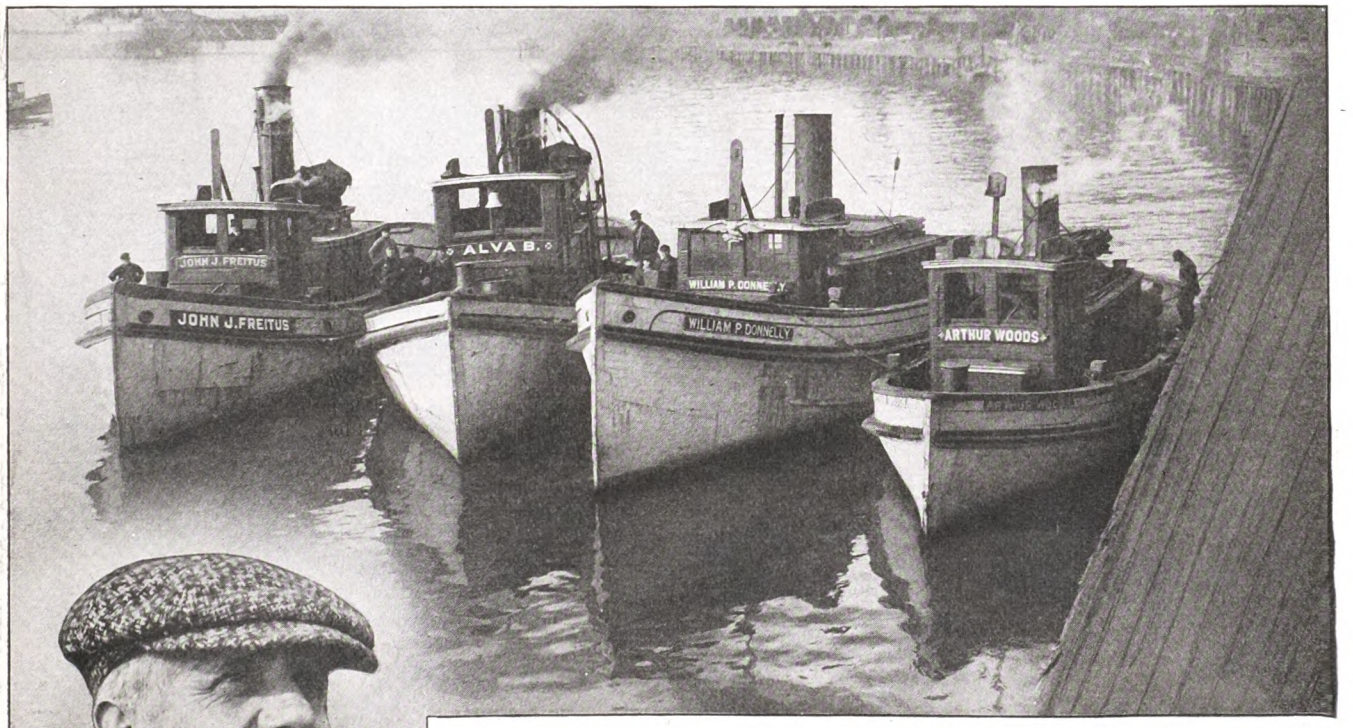
hoist, forming a diamond; in the center of the diamond the letter "T" in red.

Lake Ice Report

The reports from the regular and display stations of the weather bureau and the meteorological service of Canada indicate that the ice fields in Superior are extensive and heavy; the fields extend along the south shore from Duluth to White Fish Point and also along the east shore with open water along the north shore from Beaver Bay eastward; the fields to the west of Keweenaw Point are moving slowly with the winds. The ice in St. Marys river averages from 26 to 29 inches and is solid. In Green Bay the ice ranges from 15 to 30 inches.

Over northern parts of Lake Michigan the fields are heavy and extensive and have been reported as reaching, at times, from shore to shore; over the southern portion the fields are heavy, but moving with the winds. At the Straits the ice averages 20 inches and is heavy at the west end. In Lake Huron there are heavy and extensive fields over the northern portion, with open water off Oscoda, and heavy fields over the southern portion with three-quarters of a mile of open water at the mouth. The St. Clair river is open and practically free of ice to below Algonac. The ice is running steadily out of Lake St. Clair and the Detroit river is open to or below Fighting Island, and open water off Amherstburg. In Erie the fields are extensive and heavy with but little movement. In Ontario the harbors are frozen solid, but there are only a very few fields reported visible in the lake.

In comparison with the average of 10 years, the ice is 11 inches thicker at Duluth, 7 inches at Sault Ste. Marie, 2 inches at the Straits and 6 inches at Escanaba. The past winter has been severe and the ice is heavier and more windrowed.



The Four Sturdy Tugs at Dock in the Buffalo Harbor

CAPT. J. J. FREITUS
President and treasurer, American Towing Co., Buffalo

Tug Fireman to President

FROM the engine room to the president's office—this is the career of J. J. Freitus, one of the best known men in Buffalo marine circles. Mr. Freitus began as a fireman for the old Maytham and the Hand & Johnson tug lines. Now he is president and treasurer of the American Towing Co.

After serving for some time as fireman, Mr. Freitus was granted an engineer's license and in that capacity he operated some of the best tugs of the Hand & Johnson line. Again advancing, this time to a captain's berth, Captain Freitus decided to grasp the first opportunity to establish an independent towing company at Buffalo, and in the fall of 1914 he founded the American Towing Co. with two tugs.

The captain, with his characteristic vigor, was not content to wait for business to find him, but went after it. He sent his tugs several miles from the harbor, racing for a commission. The results have been gratifying to Captain Freitus and the present business of the American Towing Co. demands the services of the four tugs shown in the accompanying illustration and embraces the towing for the fleet of 35 vessels of the Great Lakes Transit Corporation. The captain also has had several government breakwater contracts.

In working to build the business of the towing company to its present status during the past two years, he naturally has had to overcome the discouragements which usually confront a new company. He counts as one of his most important rewards, the fact that he has gained the friendship of many vessel owners and captains who appreciate the work he has done for them and enjoy his keen personality.

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Latest Marine News in Pictures

Payment Will Be Made For Acceptable Photographs

In October, 1914, Sir Ernest Shackleton, geologist, adventurer, explorer, and scientist, set sail from Buenos Aires for the polar south. His was no glory-seeking attempt to reach the pole—Amundsen and Scott had beaten him to that goal—but an expedition for the purpose of discovering new lands in the ice-locked south and exploring as thoroughly as possible the little known continents of the antarctic. The plan called for a meeting of the Shackleton expedition with one headed by Captain Æneas Mackintosh, who was to set out with his party from the Ross sea, on the other side of the pole. Both parties met with disaster, and the hardships and thrilling experiences encountered by the Shackleton expedition may be partially comprehended from the accompanying photo-

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Photographs From Far and Near

Contributions For These Pages Are Solicited

graphs, taken by Frank Hurley, photographer for the expedition. The great ice floes, the shifting bergs and above all the treacherous cracks provided plenty of excitement for the hardy crew that manned ENDURANCE, *Shackleton's ill fated ship. The ice pack gripped the ship early in the fall and she was ice locked for eight months while the mammoth floe zigzagged back and forth across the Weddell sea. The tremendous pressure exerted against the sides of the ship threatened many times to crush her. Finally, after being lifted bodily out of the ice and thrown on her side, as shown in the illustrations, she was so badly crushed that when the pressure relaxed,* ENDURANCE *slipped down into a crack and sank in the Weddell sea in October,* 1915.

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Keeping Boilers Free From Scale

The Author Explains How Graphite is Used to Eliminate the Ill Effects of Boiler Scale and to Preserve the Water Tubes

By W. R. Starr

THE marine engineer who desires to operate his plant efficiently is beset by many of the same difficulties that confront his co-worker in the stationary plant. If anything, the marine engineer has probably more difficulties to overcome and meets more adverse conditions than the stationary engineer. Some of the difficult problems the marine engineer must solve occur intermittently and others are always present. The engine may run hot for a while and then may cool off, run smoothly and generate its maximum power. Occasionally there is trouble with the grade of coal, and at other times a combat with the elements. These, as I have said, are intermittent troubles.

One problem, however, is always present and has existed ever since James Watt watched the steam coming from the kettle on his stove and realized the possibilities of it for the generation of power. The reference is to the solids in boiler feed waters which, when coming into contact with the heat of the flues, precipitate into hard incrustations commonly known as boiler scale. Regardless of how carefully boiler feed water may be treated, and regardless of what chemicals may be introduced into the boiler or into a softening or purifying system, the problem to some extent still remains. There is certain to be scale of some kind that will form, and even an egg-shell thickness of it reduces considerably the efficiency of the plant, and increases the fuel consumption.

Advantages in Treating the Water

Some experts have contended that the best method to keep a boiler free from scale is to subject the water to treatment before it enters the boiler. This is true to some extent and there is much to be said in favor of this plan, but even though the water is carefully treated before it enters the boiler there are certain solids that will pass in with the water and be precipitated by the heat. Then, too, the very chemicals that are used to treat this water before it enters a boiler may have some harmful effect upon the boiler or such vulnerable parts, as the valve seats, packing, manhole gaskets, etc. In many cases chemicals actually attack, corrode and pit the flues, stay-bolts, etc., resulting in shorter life of the boiler and frequently causing bad leaks.

That it is advisable to reduce the scale accumulation is obvious because it has been conservatively figured that the average scale of from 1/32 to 1/16-inch in thickness causes a loss in heat transmission of approximately 10 to 12 per cent. In some cases the scale builds up so rapidly and becomes so thick that the fuel loss frequently is as high as 60 per cent. The difficulty in getting up steam in such cases is necessarily great, aside from the frightful waste of fuel.

Boiler Scale Causes Deterioration

Fuel waste is not the only or even the greatest reason for carefully keeping the boiler free from scale. The heat of a boiler furnace is intense, particularly when the fire is run continuously under forced draft. With clean tubes and plates this heat is quickly passed into the water where it does it useful work in the generation of steam. The heat does not remain in the metal. But if some non-conductor of heat accumulates between the fire surface and the water, as for instance boiler scale, the heat that formerly did useful work in making steam is now retained in the fire surfaces of the boiler. It tends to burn the carbon from the iron and thus to weaken the metal. The boilers soon lose their strength under this influence, blister or bag, and thus a very expensive piece of equipment becomes badly damaged or ruined.

Realizing the necessity for guarding against such contingencies engineers of all kinds, business men, chemists, and some of the brightest of mechanical experts have devoted their energies and learning to discover a solution of the boiler scale problem. Until a few years ago they were rewarded with but mediocre success. Thousands of chemicals have been compounded. In some few instances they have been successful but many more have been failures. Within the last few years, however, Mother Nature has accomplished that which had taxed the ingenuity and skill of man. She has furnished a scale remedy for boilers that seems to be effective in all waters and at the same time seems to exercise a beneficial and harmless effect on the metal of the boiler. From the depths of the earth she has given up to man amorphous graphite, a certain grade of which is said to be a suitable boiler-scale remedy. Since the discovery that this graphite would clean boilers without injurious effect, the care of steam boilers has been simplified and made easier.

This particular grade of amorphous graphite was found by its miners to be peculiarly adapted for the purpose, possessing certain physical peculiarities not always apparent to the uninitiated, that make it a successful boiler scale remedy, when other grades of graphite fail.

As stated in previous paragraphs, nothing has been found as yet which will always absolutely prevent the formation of scale. Obviously then the best thing to do is to use something which, when mixed with feed water, will prevent without damage to the boiler the accumulation of hard scale which is so difficult to remove. This amorphous graphite is used to accomplish this and, in some cases totally to arrest all scale development. Through its mechanical action in the tubes it will efficiently remove old scale of long standing and of the worst character. As its action is mechanical and not chemical, the process of breaking down the scale is necessarily slower, though this is a virtue rather than a fault, as a too rapid breaking down of the scale might occasion such a large accumulation in the boiler that would cause it to bag or blister.

All Graphites Are Not Suitable

To some people, "graphite is graphite", but this belief is erroneous. There are graphites and graphites, some running high in pure graphitic carbon and others having merely a trace of that necessary element. There are as many different grades of graphite as there are different kinds of trees in a forest or different kinds and grades of coal. Many so-called high grade graphites do carry a considerable percentage of anthracite coal, coke or other form of carbon. All these, like graphite, test as carbon and for that reason their presence is difficult to detect in some cases, and absolutely defies detection in others. Care is therefore essential in choosing graphite to remove boiler scale for if the material is adulterated, instead of loosening the scale, it often actually assists in its formation.

The theory of the removal of old scale from a boiler by graphite is easily comprehended and practical. The breaking down of old formations is dependent upon two things: First, the impalpable fineness to which the graphite should be ground and, second, its natural affinity

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for metal. Owing to the unequal expansion and contraction of the metal of the boiler and the scale in it, the latter, during alternate periods of heating and cooling becomes more or less cracked and checked. When the fire is applied to the cold boiler the metal will expand rapidly, the scale does not, and therefore cracks, checks and fissures open in the scale from the surface to the metal.

How the Graphite Works

The presence of these little cracks gives an opportunity for the proper graphite to disintegrate and break down old scale regardless of its character and thickness. Circulating with the water the graphite works into and through these openings (which otherwise are almost immediately recemented by the scale-forming matter in the water) and deposits on the inner surfaces of tubes and shell between the metal and the scale. The result is that the latter will no longer adhere tenaciously and may be removed with comparative ease. These cracks cannot be recemented because they are coated with graphite from the surface of the scale to the metal. Owing to the convulsions that occur continuously in a boiler when under steam, a piece or slab of scale momentarily is released from the metal. The graphite immediately passes in between the slab and metal and it cannot be recemented. If the scale is thick, it sometimes comes off in large strips or slabs; if thin, it sloughs off in the form of sludge or small scales. After a boiler has been once cleaned of its accumulation of old scale the continuous use of correct quantities of graphite will effectively prevent the subsequent formation of the hard scale because it will, as stated previously, form in and with the scale matter and keep the latter in such a loose, soft condition that it may be taken out easily.

With some waters the graphite may entirely prevent the formation of the scale that may not be eliminated by blowing down and washing out. Generally speaking, however, most feed waters carry scale forming materials in such a quantity that a coating will form to some extent in spite of the presence of graphite; but the graphite will make the coating so soft that it may be removed with comparative ease, thus making boiler cleaning more simple.

The action of the graphite in keeping the scale soft is similar to its action when mixed with concrete. A small amount of cement can be mixed with water and allowed to set. It will become as hard as flint. On the other hand, take the same quantity of cement and water mixed with a very small portion of this finely-powdered, amorphous graphite and the cement will not set hard; it can even be crumbled and broken quite easily with the hands. While scale forms in some instances despite the use of graphite, the graphite mixing with the scale not only keeps it soft, but makes it a far better conductor of heat than would be the case if the graphite were not present. Scale impregnated with graphite is a better conductor of heat and exercises the same functions as graphite in crucibles, which are made of graphite because of its great heat conducting qualities. As a matter of fact, graphite, next to metal, is one of the best heat conductors known.

The use of the graphite in preventing the formation of scale is simple. It is continuously introduced into a boiler with the feed water in the proportion of approximately three ounces to every 1,000 gallons of water evaporated, or about one pint (¾ pound) to 100 horsepower for every 10 hours of operation. This graphite therefore is in continuous circulation in the boiler. Both graphite and the solids of the water which are being precipitated through the agency of the heat, have an affinity for each other. They may float for a while as light flocculent particles on the top of the water, gathering together and getting heavier all the time until finally they settle into a kind of sludge or mud that is easily disposed of through the blow off.

Another great advantage in using the graphite, in addition to satisfactory disposition of scale difficulties, is that it does its work without harm to the boiler. Instead of exercising a pitting or corrosive influence on the metal it tends to coat and protect the metal from the corrosive influences of any free acids that may be in the water.

Magnet to Find Ships?

A sub-sea magnet invented by a Japanese scientist named Nakahara is designed to be instrumental in locating many of the sunken submarines, warships and transports which have gone down in comparatively shallow water. Recent tests of the magnet over the Japanese naval target grounds are said to have disclosed thousands of projectiles fired in practice. At the present price of scrap iron, the 600,000 *shells which lie scattered at the bottom of the Japanese bays are worth some* $3,000,000. *It is hoped to use the magnet in extracting the shell scraps from the soil of the European battlefields.*

The Dominion government has awarded contracts for two auxiliary schooners, one to the Wallace ship yards, North Vancouver, B. C., and the other to the Cameron Genoa Co., Victoria, B. C. Each of the schooners will cost about $250,000.

Book Review

Strength of Ships, by Athole J. Murray; cloth, 400 pages, 6x9 inches; published by Longmans, Green & Co. and furnished by *The Marine Review* for $5 net.

The increasing complexity of ship construction is producing a growing demand for a fuller and more widespread knowledge of the strength problems underlying ship design. Up to the present, few, if any, books have been published in the English language devoted to this subject exclusively. *Strength of Ships* is designed to meet this need.

The subject has been treated from a practical standpoint, although some intricate calculations have been introduced, especially where the researches are new, as for instance, when dealing with the subjects of bulkheads, curved bars and stanchions. Ship builders will find the section on bulkheads of interest in that a logical method for co-ordinating bulkhead test data is presented.

The elements of the theories of stress, strain and elasticity are concisely set forth, and later their application is shown to problems of design involving beams, columns, shafts, bulkheads, plating, riveting, brackets, rudders and miscellaneous fittings. Considerable space is devoted to longitudinal and transverse strength.

New Hudson Bay Dock

A dock, capable of accommodating ocean-going vessels, has just been completed at Port Nelson, on Hudson bay, according to an announcement by Captain Freakly, government navigation agent at the new northern port. The dock, built at the mouth of the Nelson river, 3,000 feet from shore, is connected with the mainland by a steel trestle over which trains will run to reach the ships.

Captain Freakly said that grain elevators and warehouses will be located on the new dock, which was built far out in the river, because of extensive tide flats between navigable water and the mainland.

Lewis M. Stoddard, lighthouse inspector at Milwaukee, Wis., has issued notice that when Milwaukee light vessel No. 95 is returned to her station, the intensity of her light will be changed from 500 candlepower to 1,000 candlepower, and the characteristic will be changed from occulting white, 15 seconds, light, 12 seconds, eclipse, 3 seconds to group occulting white, 15 seconds, light, 1 second, eclipse, 1 second, light, 1 second, eclipse, 1 second, light, 1 second, eclipse, 1 second, light, 8 seconds, eclipse, 1 second.

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American Ship Yard Activities

A Snappy Summary of the Leading Events of the Month in the Vessel Construction Field

World's Merchant-Ship Building in 1916

THE bureau of navigation, department of commerce, from various unofficial sources entitled to credence, estimates that the merchant shipping built in the world during the calendar year 1916 numbered 2,505 vessels of 1,899,943 gross tons,while during the same period 1,149 vessels of 2,082,683 gross tons were lost through war causes, a net reduction of about 200,000 gross tons, or one-half of 1 per cent of the world's merchant shipping, which comprised 48,683,136 gross tons, according to Lloyd's register in June, 1916.

The construction of merchant ships for 1916 may be divided as follows:

Country.	Vessels.	Gross tons.
Built in the United States..	1,213	560,239
Built in U. K. & Brit. dom.	510	619,336
Built in oth. for'n countries.	782	720,368
Total	2,505	1,899,943

The figures for the United States are from the official returns of the bureau of navigation of vessels built and officially numbered for American owners, numbering 1,163 of 520,847 gross tons and 50 vessels of 39,392 gross tons built and delivered to foreign owners. All these are completed and delivered ships.

The figures for foreign countries are taken from the annual ship building review of the Glasgow (Scotland) *Herald*, a statement issued at the end of each year for many years past, and usually accepted as authoritative, subject to minor modifications from official publications, which appear much later. Of the United Kingdom totals, 412 vessels of 582,305 gross tons, the Glasgow *Herald* says: "In accordance with the request of the admiralty and the board of trade, all details of the work done in the ship building yards of the United Kingdom are omitted. The returns from all the districts has been compiled with as much detail as in previous years, but we are not able to give more than the bare totals." For the British dominions the *Herald's* returns are in detail, covering 98 vessels of 37,031 gross tons, making a total for the United Kingdom and British dominions of 510 vessels of 619,336 gross tons.

The Glasgow *Herald* figures for other countries are given in detail, but in some instances include ships launched and not completed, offset in part by the fact that in some instances vessels completed late in December may not have been tabulated. Excluding warships the details for merchant vessels built in 1916 are as follows:

Country.	Vessels.	Gross tons.
Japan	250	246,234
Holland	297	208,180
Italy	30	60,472
Norway	70	44,903
Sweden	35	40,090
France	10	39,457
Denmark	30	37,150
Germany	18	25,950
Spain	4	10,071
China	38	7,861
Total	782	720,368

From Belgium, of course, no information comes, and Russia reported no merchant ship building. Of the figures the *Herald* remarks:

"In Japan the total was almost three times that of 1915, the increase being accounted for principally by the construction of a good many large cargo steamers. In Holland the ship builders have been working under exceptional difficulties, and one firm states in its report that owing to the increasing difficulty of obtaining materials stagnation in the industry is threatened. With regard to the German figures, it is not for a moment pretended that these represent the work done in that country. They only represent the work of which information has been received, and these are probably a small part of the total, while the reports, particularly those respecting the two warships understood to have been launched, were not always very definite."

Practically all the ships built were cargo boats. Of the notable exceptions and of the largest cargo boats this newspaper says:

"The largest vessels launched in the United Kingdom were the Royal Mail steamer BRECKNOCKSHIRE, of 12,000 tons, at Belfast, and the Ocean Line steamer TYNDAREUS, of 11,000 tons, at Greenock. Abroad the record for size is held by the turbine liner PARIS, of 24,000 tons and 45,000 indicated horsepower, at St. Nazaire, while there were also the Italian turbine liner DUILO, of 21,700 tons and 22,000 indicated horsepower, at Sestri Ponente; a Hamburg-South American liner of 21,500 tons, said to have been launched at Hamburg; the two splendid Italian steamers MILAZZO and VOLTURNO, each of 11,477 tons, built at Spezia; a cargo steamer of 10,700 tons at Dunkirk, France; and an oil tanker of 10,050 tons at Newport News."

The war losses of the world's merchant shipping are taken from the monthly tables of the New York *Journal of Commerce*.

Revive Old Maine Yard

The ancient industry of ship building is to be revived at Kennebunkport, Me. R. F. Norton and George H. Clark have formed a partnership and have leased the David Clark ship yard from the heirs of the David Clark estate and are to refit it. It is expected that it will be two months or longer before the firm will be ready to lay down its first keel, which will be for a three-master of some 400 tons burden. Mr. Clark is a nephew of the late David Clark, who was noted as a ship builder.

The last ships built at the David Clark yard were the schooners SAVANNAH and GOLDEN BALL. This was 16 years ago and both are still afloat.

Cunard's New Ships

James McNaught, of Esplen Sons & McNaught, Inc., naval architects, who has acted for the Cundard Steamship Co. in placing orders for ships in American ship yards, stated recently that: "Details of Cunard ship building cannot be given, as the company is under British censor, but I can say that the program is the greatest in history of ship building. Orders are being placed in almost every available yard. The Bethlehem Steel Corporation is to build ships at the Maryland and Fore River yards and Union Iron Works. The Todd Ship Yards Corporation has orders for six ships of 7,500 tons at its Seattle yard. The Sun Ship Building Co. also has orders.

"Ships to be built in the United States vary from 7,500 to 12,500 tons. Several steamers are being built for the Cunard

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line in England, and at least one will have turbo-electric propulsion. At present England has three or four ships under construction of that class. One of the small steamers with the new power is to be 5,500 tons. These vessels will have a high speed. We have found that electric installation can be so constructed as not to reduce carrying capacity and need not add to the weight of the vessel."

New Pacific Company

Fred A. Ballin, naval architect and mechanical engineer, Portland, Ore., has formed a partnership with Joseph Supple, ship builder, Portland, and J. B. C. Lockwood, civil engineer, Portland, under the firm name of Supple, Ballin & Lockwood. The new firm will engage in ship building and general engineering work. The company's plant has been established at East Oak and Water streets and contracts already have been secured for the construction of two large wooden motorships of 4,000 tons deadweight capacity for the Gaston, Williams & Wigmore Steamship Corporation, New York. These ships will be built according to Mr. Ballin's patent system of wooden construction, embracing a double diagonal planked skin with fore and aft planking on top of the diagonals and steel reinforcements on the top sides. These boats are considerably larger than have usually been attempted heretofore. They are 305 feet in length over all with 44-foot beam and 26-foot molded depth. Each boat will be propelled by two 500-horsepower Winton diesel engines, which are expected to give a speed of nine knots when the vessel is loaded. Fred A. Ballin has been prominent in marine circles on the Pacific coast for a number of years. He also has had considerable experience in ship building on the Great Lakes. For a time he was associated with the Willamette Iron & Steel Works, Portland, Ore. He also is the designer and builder of the Ballin water-tube boiler, which has been extensively employed in passenger steamers on the Pacific coast. Joseph Supple has been building wooden vessels on the Pacific coast for a great many years, specializing on fast passenger steamers. Mr. Supple built KITSAP, HYAK and other steamers in the fleet of the Kitsap County Transportation Co., Seattle. J. B. C. Lockwood is an engineer with experience in hydraulic work. For a number of years he was chief engineer of the Port of Portland. He has had experience in the construction of dredges and other apparatus for the improvement of harbors and waterways.

Dry Dock at Vancouver

Arrangements have been completed for constructing a large floating dry dock at Vancouver, B. C. The structure will be a 16,000-ton, double-section dock, capable of handling a boat of 18,000 tons, which is the measure of maximum requirements on the Pacific today. The company is the Vancouver Dry Docks, Ltd. Bonds to the amount of $2,000,000 have been sold to a Cincinnati firm. A ship repair and ship building plant is a part of the plan decided upon. Contracts for construction and machinery are being let, and the company announces that it will have the dock in operation within a year. There will be subsidy aid from the governments of both the Dominion of Canada and the province of British Columbia, on the ground that the dock will be a commercial and naval asset. Steamers sailing from Canadian ports on the Pacific at present are forced to dock for repairs at Hongkong, at Kobe, Japan, or in Australia.

New Type of Barge

At the yard of the Johnson Ship Yard Corporation, Mariners Harbor, Staten island, two barges of the type shown in the accompanying illustration are being constructed. These barges are the first of a fleet being built for the Cullen Barge Corporation, New York. The barges now under construction will each have a carrying capacity of 1,500 tons. The barges will be equipped with improved methods and facilities for loading and discharging. The quarters for the master and crew are to be modern in every respect.

Both of the barges will be placed in the Long Island sound trade. The rest of the fleet will be built as rapidly as construction facilities permit. The barges are being built under the personal supervision of Joseph A. Johnson, who for 24 years was superintendent of the Staten Island Ship Building Co. Edward F. Cullen, president of the Cullen Barge Corporation, has had many years of experience in the barge business.

Contracts for five vessels, including two for the United States bureau of fisheries, Alaska department, one for the United States immigration service and two for the Apex Fish Co. have been secured by the Elliott Bay Yacht & Engine Co. for $30,000.

1,500-TON BARGE FOR SERVICE IN LONG ISLAND SOUND

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Foresees Sharp Decline in Freight Rates

A considerable decline in ocean freight rates and consequent depression in general shipping conditions shortly after the end of the war, due to a falling off in the world's commerce, is foreseen by F. C. Munson, president of the Munson Steamship line. In this opinion, expressed in an interview granted to a representative of The Journal of Commerce, Mr. Munson, is supported by many shipping men, but equal support is found for the belief that after a brief slump immediately following the conclusion of hostilities, several years of prosperity will be experienced. Mr. Munson, who was asked for his opinion as to the condition of shipping at the end of the war, said:

"The effect of the end of the war is bound to be the lowering of rates, but it will be gradual or quick, according to the amount of tonnage that may be available to take its place in the regular channels of trade throughout the world.

"The present cause of high rates is the shortage of tonnage caused, first, by the internment of all German tonnage, and second, by loss from mines, torpedoing and marine risks of a large amount of British and neutral tonnage of the world's fleet. The amount of tonnage so destroyed since the beginning of the war up to Nov. 1, 1916, was approximately 5,500,000 to 6,000,000 deadweight tons. In addition to these sources, there has been a large amount of tonnage removed by requisition on the part of the British government. This tonnage cannot be accurately estimated, but there is a very small proportion of the usual number of British steamers now navigating in the commerce of all neutral countries.

"The amount of interned German tonnage is estimated to be somewhat over 4,000,000 tons, which, with the above, makes a total amount of tonnage removed from the world's fleet of about 10,000,000 deadweight tons. The total deadweight tonnage of the world's fleet in normal times is about 40,000,000 to 45,000,000 tons, which means that there has been removed from the commerce of the world about 25 per cent of its tonnage and this clearly shows the reason for the present high rates.

"The amount of tonnage which has been built is difficult to ascertain because of the fact that no figures are available for what merchant tonnage England has built during this period.

"At the end of the war there will be available, gradually, some 4,000,000 tons of German tonnage now interned, and this by itself will have the effect of causing an immediate drop in rates, as will also the release of a large amount of British tonnage now running for the government under requisition. This latter, however, will be a gradual release, since troops, impedimenta and supplies must mostly be returned to their original base before all of the tonnage can be released.

"The consumption of the world has decreased because of the war, particularly in European countries affected, and will probably continue to be below normal by a considerable percentage for some years after the war is over because of heavy taxation and hard times. It is probable, therefore, that within two years after peace is declared there will be a general demoralization of rate conditions caused by competition, and steamship lines may see very poor rates prevailing until the consumption of goods throughout the world has increased to a more normal basis."

United Fruit Co. Orders Four Vessels

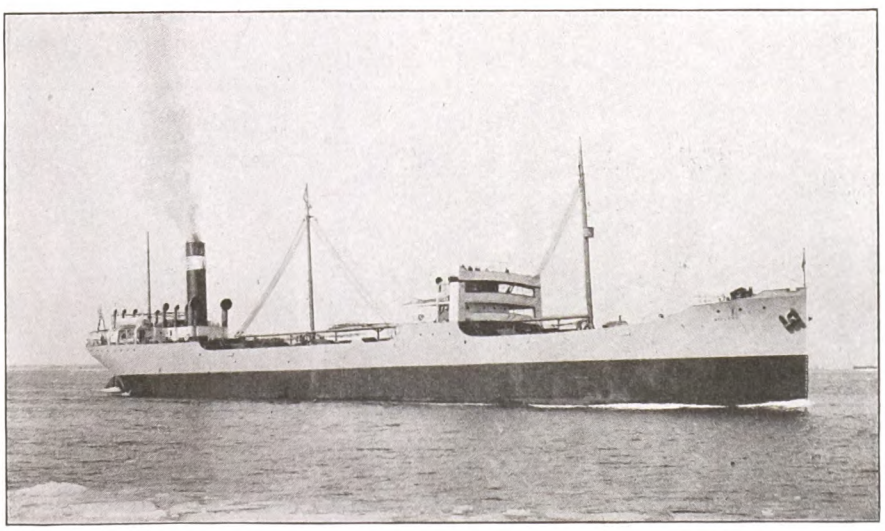
Contracts have been signed by the United Fruit Co. with the Harlan & Hollingsworth Corporation, Wilmington, Del., for the construction of four vessels. This brings the number of ships under construction for the company in the United States to a total of eight, while in England there are seven ships building, which have been requisitioned by the British admiralty.

Specifications for the vessels to be built in this country are not completed as yet, but the deliveries are to be made in from one and a half to two years from the beginning of this year. The new boats are to be about of the same character and tonnage as the latest ships built for the company, but are to be a trifle larger and faster than anything now owned by the United Fruit Co.

Within the next two years the United Fruit fleet will be increased to 59 ships, exclusive of chartered tonnage. Twenty-three ships of the fleet are now under the American flag.

Tanker Mielero

An indication of the feverish demand for freight steamers is found in the fact that although the large steel tanker MIELERO, built by the Fore River Shipbuilding Corporation for the Cuba Distilling Co., New York, was launched less than a month before she left the Fore River yards on Feb. 17 to go immediately into commission. MIELERO, the third of a fleet of these tankers built by the Fore River Shipbuilding Corporation for the Cuba Distilling Co., is designed to carry molasses in bulk north and petroleum in bulk south, without renovating the tanks. She has a carrying capacity of about 1,500,000 gallons of molasses and about 2,250,000 gallons of oil, the cargo deadweight being a little over 8,000 tons. Her length between perpendiculars is 389 feet and she is propelled by a vertical triple-expansion engine.



MOLASSES AND OIL CARRYING STEAMER MIELERO

Under a ruling by Postmaster W. J. Nagel, the marine post office at Detroit is hereafter to be known as the Detroit river station. A report on the work of this post office shows that during 1916 approximately 900,000 pieces of mail were handled and 20,000 boats served. The money order business totaled $17,000 and the stamp sales amounted to $15,000. The office is in charge of W. S. Winckler, superintendent, and is kept open throughout the winter.

Sixteen ship building companies in Oregon have contracts for the construction of sea-going vessels to cost more than $25,000,000. During the past year contracts for 65 vessels were closed, 16 of which were for large steel freighters for foreign interests. Most of the others were auxiliary schooners.

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On the Coasts, Lakes and Rivers

What's Doing and Who's Doing It

Lake Interests Await Spring Rush

By A. A. Eiben

ICE conditions at the head of the lakes during the first week in March were unusually severe, and it seemed likely that the opening of the navigation season this year will be late. In a bulletin issued by R. A. & W. M. Williams, Duluth, it was stated that the ice in Duluth harbor averaged 38 inches, 11 inches more than normal and 5 inches greater than on the same date last year. In the open lake the ice averaged about 20 inches and extended beyond vision. Conditions early in March were almost identical with those obtaining at the same time in 1904, when the navigation season did not open until May 12.

* * *

The collision case, involving the steamers NOTTINGHAM and W. GRANT MORDEN, which was scheduled for trial in the United States district court at Buffalo on March 7, has been settled out of court. These vessels collided during a fog in Lake Superior near Manitou island on July 27, 1916, and both vessels had filed claims for $50,000 damages. NOTTINGHAM was represented by Goulder, White & Garry, and MORDEN by Holden, Masten, Duncan & Leckie.

* * *

It is estimated that there will be from 300,000 to 500,000 tons of coal at Duluth-Superior at the opening of navigation this year, as compared with about 2,500,000 tons last year.

* * *

The Great Lakes Transit Corporation, Buffalo, has announced an increase in freight rates, effective at the opening of navigation. Average increases of 6 per cent per 100 pounds will be made for the transportation of the six classes of freight from Cleveland and Buffalo to Duluth, while the increase for carrying to Duluth by lake and thence to St. Paul by rail will be 4 per cent. The increase on less than carload lots of iron and steel to Duluth will be 4.8 per cent, and to St. Paul 10.1 per cent. The carload lot increase to Duluth will be 5.3 per cent, and St. Paul 22.5 per cent.

* * *

The Sheadle cup, offered in the pool tournament conducted by the Lake Carriers' Association, was won by the team representing the Marine City Licensed Officers' assembly rooms, on a percentage of 0.722. The team consisted of Joseph Rose, John B. Woods and Russell Leach. It won 52 out of 72 games played. Russell Leach made the highest individual score, losing only one game, which was taken by William Bishop of the Cleveland engineers' team. The Sheadle cup, presented by the late J. H. Sheadle, was won in 1914 and 1915 by the Cleveland engineers and in 1916 by the Detroit licensed officers. One team must win the trophy three successive years to retain it.

* * *

C. H. Williamson, Buffalo manager for Lunham & Moore, recently issued an interesting statement covering the grain situation at Buffalo. At the close of navigation in 1916, 80 vessels containing 23,800,000 bushels of storage grain were moored at Buffalo. Of this amount, 14,732,473 bushels had been unloaded on March 1, leaving 9,067,527 bushels still afloat. Considering the handicaps which were encountered in the way of car shortage, low stages of water, and the scarcity of ocean-going vessels, the showing made up to March 1 was a creditable one. It is practically certain that all vessels will be unloaded well in advance of the opening of navigation.

* * *

The steamers WILLIAM A. REISS and RICHARD J. REISS, of the Reiss Steamship Co.'s fleet, Sheboygan, Wis., are being reconstructed at the yard of the Manitowoc Ship Building Co., Manitowoc, Wis. The hatches of these vessels are being altered to the 12-foot type with 24-foot centers. The steamers will be divided into three compartments each. WILLIAM A. REISS and RICHARD J. REISS were formerly the steamers FRANK H. PEAVEY and GEORGE W. PEAVEY.

* * *

A report from Conneaut indicates that the amount of ore on dock on March 1 was the largest in the history of the port. Much delay in shipping resulted from the difficulty of handling frozen ore, although the shortage of cars was also a big contributing factor.

* * *

The Chicago, Milwaukee & Racine Steamship line recently closed negotiations for erecting a steamer terminal at Milwaukee. The dock will be located below the Northwestern railroad bridge near the harbor. Construction work will begin immediately and will be rushed in order that part of the dock may be ready for use during the coming season. The cost of the structure will be about $600,000.

* * *

The passenger steamer HURON has been sold by the Star Cole line, Detroit, to the Interlake Auto Transportation Co., Toledo. The steamer will be used exclusively in the automobile carrying trade.

* * *

The Pittsburgh Steamship Co. is negotiating for a safe harbor as a winter mooring place for its fleet of 21 tow barges. The company has an option on a tract of lake front land at Erie. That port is most favorably considered, although other Lake Erie ports, as well as the St. Clair river, are being investigated.

* * *

The Great Lakes Towing Co. recently launched the tug LOUISIANA at its Cleveland yard. LOUISIANA is an ice breaker and is equipped with compound engines fore and aft.

* * *

Capt. Fred H. Rae, 81 years old, died at his home in Vermilion, O., recently. Death was due to pneumonia. Captain Rae was a master of the old school and in his early career sailed vessels of the Bradley fleet, at one time the largest on the lakes. Later he was master of the passenger steamer STATE OF OHIO, of the Cleveland & Buffalo line. During the past five years he was agent for the Pittsburgh Steamship Co. at Calcite, Mich.

* * *

Capt. Joseph Taylor, 78 years old, one of the oldest vessel pilots on the Great Lakes, died recently at Marquette, Mich. Mr. Taylor was a resident of the Soo about 60 years ago and one of his first jobs was carrying mail between the Soo and Mackinaw. Later he took up sailing and continued to follow the marine trade until he retired. Captain Taylor was well known to masters on the Great Lakes, particularly those who sailed the lakes in the days when the old channel of St. Mary's river was used.

* * *

Capt. Miles E. Barry died at his home in Chicago recenfly, at the age of 60 years. He was a native of Kingston, Ont., and was a grand nephew of Commodore "Jack" Barry, of American revolutionary war fame. He moved to Chicago at the age of 16 years, and with his five brothers, operated the Independence Tug line, and later the Barry Bros. Transportation Co.

* * *

James A. Myers, of James A. Myers & Co., insurance and vessel brokers, Chicago, died recently.

The Mississippi Delta

By H. H. Dunn

SAN FRATERNO, British admiralty tank steamer, with a cargo of 107,000 barrels of fuel oil, collided with the Gulf Refining Co.'s barge MINGO, off Sabine bar, Tex., recently. SAN FRATERNO sustained approximately $50,000 damages. A hole 5 feet in diameter was torn in her hull. Damage to MINGO was slight. The tanker put back into Port Arthur, Tex., for repairs.

* * *

The Skinner Syndicate, Seattle, formed to raise SESOSTRIS, the 5,025-ton steamer

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of the Kosmos Steamship Co., Hamburg, which sank off the Guatemalan coast seven years ago, was successful in raising the boat. SESOSTRIS has been repaired in the dry dock at Panama and renamed ESTRADA CABRERA in honor of the President of Guatemala. The recovered steamer is estimated to be worth approximately $1,000,000.

* * *

Southern ship yards manifested more activity during January than in any previous month of their history. Three big schooners were delivered from the Clooney ship yards, Lake Charles, La. They are: GEORGE T. LOCKE, to the Aiken Towboat Co., Pensacola, Fla., and VERDA E. TURNER and SARAH E. TURNER, to Capt. W. H. Turner, Vinegar Bend, Ala.

* * *

ANNIE AINSLEE, three-mast lumber schooner, St. Andrew's Bay, Fla., to Porto Rico, went ashore on Anegada reef, and was a total loss. The captain and crew are reported safe.

* * *

The Clooney Construction Co., Lake Charles, La., has contracted to build for the Gulf Export & Transportation Co. a steamer for service between Beaumont, Tex., and Porto Rican ports. The steamer will be 208 feet long, 41-foot beam, and 19-foot hold, with a cargo capacity of 1,200 tons. The hull, exclusive of machinery, is to cost $10,000. Work on the steamer began Feb. 1. The ship is to be completed within six months.

* * *

Increase in the ship-handling capacity of New Orleans is forecast by the formation of three large companies by Doullut & Williams, marine contractors. The largest is the Southern Lighterage & Wrecking Co., organized with $200,000 capital and $100,000 surplus; the next is the incorporation of the general marine contracting business of the firm for $150,000; and third is the Southern Dry Dock & Ship Building Co. with $40,000 capital. The last concern has a dry dock and marine ways already established at Algiers. River craft will be handled at this plant.

* * *

Inland waterways from the coal fields of Alabama have resulted in an agreement between the city of New Orleans and transportation companies whereby coal brought by barges from these fields will be delivered to the municipal plant in the city at $2.80 per ton—a price about 50 per cent lower than that at which the fuel is delivered shipside New Orleans harbor.

News From Boston Bay

By George S. Hudson

Steamer TIDEWATER, owned by the Darrow-Mann Co., bears the distinction of having brought the largest cargo of coal—8,600 tons—ever landed at Boston from an American merchant vessel. TIDEWATER was built by the New York Shipbuilding Co. and will be followed next month by DEEPWATER whose deadweight capacity is 10,000 tons.

* * *

No hope is entertained for the three-mast schooner MYSTIC, formerly HOPE HAYNES, which sailed from Perth Amboy for Macoris Nov. 14, with a cargo of 400 tons of coal. MYSTIC was commanded by Capt. Henry Mueller. The vessel was rebuilt at Boston at an expense of $10,000 just before leaving on her last voyage.

* * *

One of the largest stocks recently made by a fishing schooner out of a New England port was that of WALTHAM, Capt. Merton Hutchins. The returns for seven short shore trips amounted to $6,318. Of this the crew received $238.50 each.

* * *

Boston steamship STEPHEN R. JONES, recently launched and owned by the Crowell & Thurlow Steamship Co., has been chartered for term of two years at $68,000 per month in trade between United States and South America.

* * *

Capt. H. B. West, in charge of the Boston district of the coast guard service, has been transferred to New York. Capt. F. M. Dunwoddy, of the New York district, comes to Boston.

* * *

The Shawmut Steamship Co., Boston, has ordered five steamships for offshore trade from a Chester, Pa., concern. The smallest is to have a deadweight capacity of 7,500 tons; the others, 10,000 tons. The first delivery will be made in June. The first ship will be commanded by Capt. C. F. Smith, formerly in charge of the company's steamer ORION. The new vessels will be named after Massachusetts rivers.

* * *

Capt. Nehemiah B. Kelley, Harwichport, Mass., has been elected trustee of the Boston Marine society to fill the vacancy caused by the death of Capt. Elkanah Crowell.

* * *

Three-mast schooner GEORGE B. CLUETT has been sold by the Grenfell missionary association to Norwegian interests. This vessel for several years was employed as a supply boat and recently carried relief to the MacMillan scientific party in the frozen north. CLUETT is commanded by Captain Olsen and will load general menchandise for Europe.

* * *

FELIX TAUSSIG, owned by the Crowell & Thurlow Steamship Co. of Boston, has been chartered by the U. S. & South American Steamship Co. and will be operated by the Lamport & Holt Steamship Co. between Boston, New York and the River Plate.

* * *

Chester B. Kenfield, for 51 years customs inspector at Boston, recently observed his eightieth birthday anniversary. He is the oldest federal employ in the New England district.

Around Puget Sound

By F. K. Haskell

AN AMERICAN pool will take 73 per cent of the insurance on eight wooden auxiliary schooners of the A. O. Anderson & Co.'s fleet, being built in Oregon. Twenty-seven per cent has been taken by interests in Denmark, the rate being about 6½ per cent for the full amount, according to Arnold Reimann, American manager for the Anderson holdings. "One important feature of this arrangement from our standpoint," said Mr. Reimann, "is the fact that auxiliary vessels will not have to be convoyed in and out of the Columbia river or other harbors by a tug, as has been necessary with some insurance policies placed on auxiliary vessels. Also rates have been from 8½ to 9 per cent, while through our pool and with the assistance of Denmark shipping firms we shall be covered at a rate not to exceed 6½ per cent." The present convoy rate at the Columbia river is $100.

* * *

The Coast Shipbuilding Co. has been incorporated with $400,000 capital in Portland, Ore., by Arthur M. Sherwood, Donald M. Green and Charles E. McCulloch, who with James B. Kerr and A. L. Mills, will serve as directors. A modest start is to be made in construction. The policy of the company will be to turn out tonnage for sale.

* * *

Motorship building goes on apace in Tacoma, Wash., and reports of projected new ship yards continue to show that the industry is going to be a particularly booming one this year. The Seaborn Shipyards Co. has launched another auxiliary schooner, ORCAS, 175 feet x 36 feet beam and 14-foot depth. She is powered with two vertical compound engines. Frames have been raised for a 260-foot vessel which will be launched in May. This boat will be powered with two 240-horsepower Skandia engines.

* * *

Eight wooden ship building yards are now in operation on the Columbia river in Oregon, 28 vessels now being either under way or provided for. In the last year, two steam schooners and five auxiliary schooners have been launched. Two more carriers are now being converted into motorships.

* * *

Joseph Supple, Portland's pioneer ship builder, will enlarge his plant upon returning form New York, where he is closing up contracts calling for the construction of three large vessels. J. B. C. Lockwood will be associated with Mr. Supple as engineer.

* * *

Capt. Hanson B. Joyce, Seattle, one of the best known navigators in America, died recently. In 50 years as a master he never lost a ship or one of the thousands of men under his command. He retired from the sea after a half century on the waters of the Atlantic, Gulf and Pacific. Capt. Joyce's last command was BURNSIDE, in Alaskan waters.

* * *

Capt. Thomas Moore, hero of the rescue of the officers and crew of the United States coast guard cutter TAHOMA, lost Sept. 20, 1914, off Kiska island, western Alaska, and one of the most widely known navigators of northern waters, has resigned as master of the steamship CORDOVA, and has been appointed master of the Pacific American Fisheries' new freighter REDWOOD.

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Red Hot Tips From the Trade

Pertinent Suggestions and Personal Gossip

AN ATTRACTIVE catalog of interest to marine engineers has been issued by the American Veneziani Paint Co., New York, describing its various products which are used for treating ships' bottoms and hulls. One of the most important requisites in the successful operation and upkeep of steel ships is to effectively protect the hulls from the ravages of the corrosive and fouling agents of the sea. The fouling of a ship's hull greatly increases its resistance in the water and therefore not only increases the expense of operation but also materially increases the wear and tear on the machinery. The company's products, which are designed to protect the ship's plates against the galvanic action and corroding agents of the sea and at the same time to prevent the adhesion of such growths as barnacles and grass, include anti-corrosive paints and anti-fouling compositions. These compounds are supplied in several colors and may be applied to the hull without special preparation. The company points out that the general effect of using such paints and compositions is to enlarge the cruising radius, increase the speed, diminish the fuel consumption and to reduce the cost maintenance.

Power Hammers

Power hammers adapted for use by shipbuilders and shipsmiths are described in a recent catalog published by Beaudry & Co., Inc., Boston. These hammers are built in two types ranging in sizes from 25 to 500 pounds weight of ram. They are designed for light and heavy work.

New Westinghouse Plant

Announcement has just been made by the Westinghouse Electric & Mfg. Co. that the plot of ground recently purchased at Essington, near Philadelphia, will form a new industrial center for the Westinghouse interests. The site embraces about 500 acres, with a frontage of approximately one mile on the Delaware river. Additional transportation facilities will be afforded by tracks from the Pennsylvania and Philadelphia & Reading railroads.

This new center will be devoted to the production of large apparatus, the first group of buildings being for power machinery, principally steam turbines, condensers and reduction gears. The initial development will cost in the neighborhood of $5,000,000 or $6,000,000 and will occupy about one-fifth of the area of the entire plot. The group will consist of the following buildings: Two large machine shops, an erecting shop for heavy machinery, forge shop, pattern and pattern-storage shop, and power house. Work will begin on these as soon as satisfactory building contracts can be let. The number of employes to be engaged at the new plant has not as yet been definitely determined, but will number several thousand.

Portable Electric Tools

The Independent Pneumatic Tool Co., Chicago, is distributing a 4-page folder illustrating and describing in detail the company's line of portable electric drills and grinders. This line of electric tools consists of eight different sizes of electric drills with capacities ranging from ¼ to 2 inches and a portable electric grinder with a ¾ x 4-inch wheel.

These electric tools are equipped with a universal motor for operating on direct or alternating current, 110 or 220 volts. They are made with an aluminum cylinder to insure lightness, and have both ball and roller bearings. A specially constructed motor, designed to give increased capacity, is used. The folder points out how portable electric tools have come into favor on account of the ease with which they may be carried from one job to another and their adaptability to various classes of work.

New Sales Office

The De Laval Steam Turbine Co., Trenton, N. J., manufacturer of steam turbines and helical reduction gears for all classes of service, including ship propulsion and marine work; centrifugal pumps, centrifugal compressors and similar apparatus, announces the opening of a district sales office in the Smith building, Seattle, Wash., in charge of William Pullen.

Describes "Safety Suit"

An attractive circular describing a "safety suit" for use in keeping afloat has been issued by L. von Kevicky, New York. This suit, which is made of strong material, is designed in union style with shoes and mittens. It is said to be so simply constructed that it can be put on in less than a minute. Protection is afforded to all parts of the body but the face. Numerous tests have been conducted to show the ability of the suit to keep the wearer afloat and warm for an indefinite period.

Boiler-Tube Cleaner

The William B. Pierce Co., Buffalo, has issued a nicely illustrated booklet describing its boiler-tube cleaners. Information is included which outlines some of the difficulties caused by scale in boiler tubes and the relation of scale to fuel consumption. The company's cleaner is a pneumatic vibrator, which may be driven either by compressed air or by steam. The vibratory action of the cleaner in the tubes is said to quickly disintegrate and break the scale into small pieces. In this condition it may easily be removed. Several types of cleaners are made for various sizes of boilers and for straight and curved pipes.

Form New Company

George F. Thorndyke and J. D. Trenholme have formed the Thorndyke-Trenholme Co., with offices in the Railway Exchange building, Seattle. The new firm will engage in a general foreign and coastwise ship brokerage business. Both partners are well known in marine circles. For years Mr. Thorndyke was manager of the Globe Navigation Co., Seattle. Mr. Trenholme was secretary and one of the organizers of the Northwestern Steamship Co., and has been connected with other large companies at Seattle.

Among its recent sales, the Eckliff Automatic Boiler Circulator Co., Detroit, reports the following: Seven sets of Eckliff circulators to the quartermaster corps, war department, for vessels stationed in the Philippines; six sets for United States navy hospital ship SOLACE; four sets for United States army transport KILPATRICK; two sets for U. S. S. MARINDUQUE, government of the Philippine Islands, war department, bureau of insular affairs; two sets for the Standard Oil Co. of New Jersey; nine sets for Darrow-Mann Co., Boston; two sets for New England Coal & Coke Co., Boston.

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Equipment Used Afloat and Ashore

New Air Pump of Simple Construction

A NEW and interesting type of air pump for producing a high vacuum economically was recently introduced by the C. H. Wheeler Mfg. Co., Philadelphia.

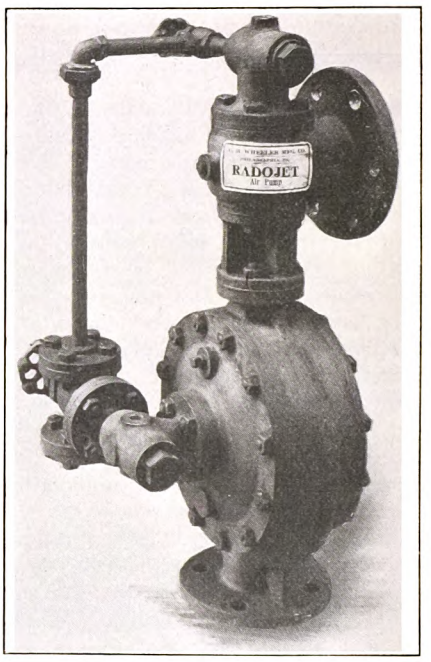
The new device is designed to perform the work of any air pump working on the dry air principle. It has no piston or valves. It is operated by live steam jets which, by passing through nozzles of special design, obtain a high velocity and entrain the air and non-condensable gases from the condenser, compressing them to atmospheric pressure.

One of the accompanying illustrations shows one of these air pumps for a surface condenser condensing about 20,000 pounds of steam per hour. This pump is extremely small, requires little space, and is light.

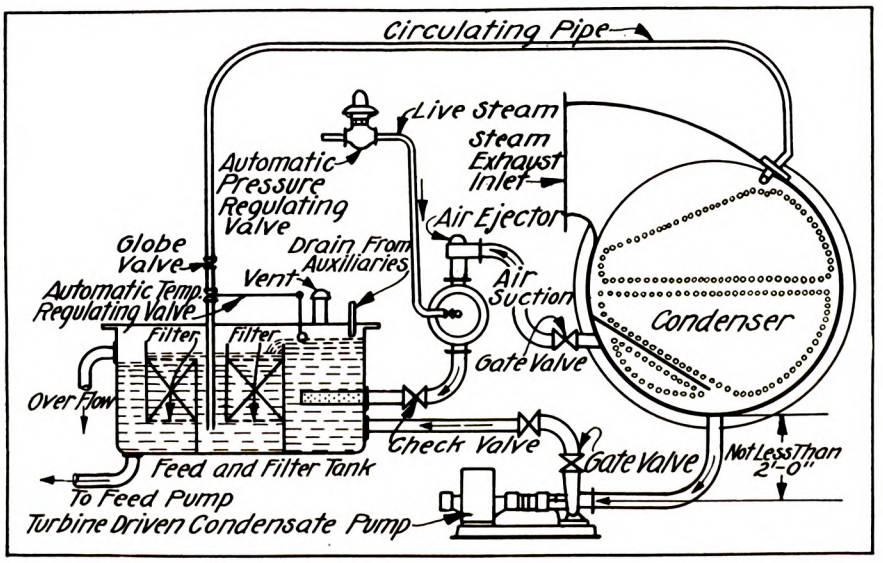
A diagrammatic arrangement of these air pumps, as used on marine surface condensers for turbines, is shown in the other illustration. The exhaust steam from the air pump is discharged into the feed tank in a condensed form, and serves to raise the temperature of the feed water. By this arrangement, all heat contained in the live steam used for operating the pump is utilized, thus giving a thermal efficiency of practically 95 per cent. The condensed steam is taken from the hotwell of the condenser by a turbine or electric-driven condensate pump and is discharged into the feed water tank, where it mixes with drains from other auxiliaries and with the exhaust steam coming from the air pump. A separating wall with an overflow is provided to force the water to rise, thereby freeing the air which escapes through a vent arranged on the top cover of the feed tank. The air pump may be located at any convenient place close to the condenser. The air suction should be arranged a little higher than the air suction of the condenser, so as to form a drain towards the condenser.

An automatic steam pressure regulating valve, supplied with the air pump, is arranged somewhere in the highest point of the live steam line. Its purpose is to maintain a constant steam pressure at the inlet of the air pump, thereby insuring a uniform steam consumption with varying boiler pressure.

The back pressure on the exhaust of the air pump should not exceed ½-pound gage. A circulating pipe with a float-operated valve is shown in the diagram. The object of this circulating pipe is as follows; if the main engines of a marine installation come to a sudden stop, as frequently occurs when maneuvering, very little water will be discharged by the condensate pump to the feed tank. As the air pump is in operation, steam will continuously enter the feed tank. The heat contained in the steam will cause an increase in the temperature of the water in the feed tank, and the water would soon reach the boiling point unless some additional water supply is provided for. The float-operated regulating valve and the circulating pipe serve this purpose. As soon as the quantity of water supplied to the feed tank becomes smaller, the water level in the first compartment of the tank will fall, thereby opening the automatic regulating valve and allowing some water to be sucked into the condenser through the circulating pipe. This water by falling down over the cooled tubes will be reduced in temperature and will be returned by the condensate pump to the feed tank, thus preventing boiling.



AIR PUMP FOR SURFACE CONDENSER



DIAGRAMMATIC ARRANGEMENT OF AIR PUMP FOR MARINE SURFACE CONDENSER

The air pump may also be used with advantage with reciprocating engines where a lower vacuum than that provided for on turbine installations is required. The reciprocating air pump, which is generally operated directly by a lever connected with links to the crosshead of the main engine, may be replaced by the Wheeler air pump for removing the air, with a small direct acting hot well pump for removing the condensed steam from the condenser.

Among the advantages of this new device is its simplicity and consequent ease of manipulation and operation. The apparatus is static. All that is required to start the device is to open the steam valve; to stop it, to close the valve.

The complete absence of internal moving parts eliminates wear, while the flexibility in locating the apparatus is of considerable importance in marine installations.

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